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Introduction

This annual statistical number of the JOURNAL is laid out on the same plan as its predecessors, but as has always been the case it comprises some new features that are important, as to which we can fittingly repeat the substance of our preface last year. Besides a comprehensive treatment of many of the minor minerals and metals, there is presented again a valuable series of metallurgical articles, reviewing the progress of 1912 in the various departments of metallurgy. Also there are numerous articles upon mining developments by leaders of the industry, many of those that are unsigned being fully as responsible as those that are. No one can turn over the following pages without a recognition of the impressive list of contributors and the authoritativeness of their summaries. To all of these contributors, who have collaborated in this number, we tender our thanks, and also to the many persons who have assisted in the collection of statistical information. Our thanks are due also to the producers of copper, lead, spelter and other substances, who have communicated to us the amount of their output in 1912 and have thereby enabled close approximation to the actual production in 1912 to be made by Jan. 8, 1913, our date of going to press.

PRODUCTION OF METALS IN THE UNITED STATES

Metal	Unit	1910	1911	1912
Copper (*a*)	pounds	1,086,249,983	1,083,856,371	1,242,836,024
Ferromangese	long tons	224,431	184,717	202,186
Gold (*b*)	dollars	96,269,100	96,890,000	91,685,168
Iron	long tons	27,079,136	23,464,627	29,445,068
Lead (*c*)	short tons	392,704	400,958	418,224
Nickel (*e*)	pounds	32,050,032	29,545,967	33,311,233
Quicksilver	flasks	22,418	21,500	(*f*) 25,147
Silver (*b*)	troy ounces	57,137,900	60,399,400	62,369,901
Zinc (*d*)	short tons	277,065	295,836	347,922

(a) Production from ore originating in the United States. (b) The statistics for 1910 and 1911 are the final and those for 1912 are the preliminary statistics reported by the director of the Mint. (c) Production of refined lead from ore and scrap originating in the United States; antimonial lead is included. (d) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (e) Imports for 1912, first 10 months only. This nickel is refined in the United States for the production of metal, oxide and salts. (f) As reported by U. S. Geological Survey.

PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES

Substance	Unit	1910	1911	1912
Arsenic	pounds	3,052,000	6,162,000	5,852,000
Coal, anthracite (b)	short tons	82,670,235	492,647,863	511,964,403
Coal, bituminous (b)	short tons	411,126,408	402,121,307	427,655,966
Coke (b)	short tons	36,056,059	34,972,534	41,803,199
Copper sulphate	pounds	26,356,788	33,454,000	39,480,741
Iron ore	long tons	53,267,397	41,878,190	59,485,477
Petroleum	barrels	210,588,308	218,372,850	218,970,815
Tungsten ore	short tons	2,130	1,139	(c) 1,290

(b) All coal and coke statistics are the estimates of *Coal Age*. (c) As reported by the U. S. Geological Survey.

The production of the more important minerals and metals is summarized in the table on this page. The details appear in subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this huge number in a few days leaves no time for leisurely comparison and revision to effect a careful coördination of all the data. We feel sure that no one, in the light of this explanation, will be misled by any discrepancies that may be discovered.

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We commend to our readers a careful reading of the remarkable series of reviews of metallurgical progress that appears in this issue. Mr. Huntoon writes of stamp milling, Professor Hofman of the metallurgy of lead, Professor Walker of the metallurgy of copper, Mr. Stoughton of the metallurgy of iron and steel, Messrs. Argall and Megraw of cyanidation and Mr. Cranston of gold dredging. All of these contributions are of national reputation as experts in their specialties; several of them are of international reputation. Such contributions as they offer in this issue are real enrichments of technical literature and are especially valuable to the general practitioner as expert summaries of what has been done in technical metallurgy that really amounts to something.

❋

American mining companies that publicly announce their dividends paid $67,832,442 in 1912, compared to $56,971,791 in 1911. Canadian and Mexican companies paid $21,130,597 in 1912 and $15,934,911 in 1911. American metallurgical companies paid $99,599,094 in 1912 and $94,044,899 in 1911.

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The huge productions of the metals in 1912 being made coincidently with a high range of prices created remarkable prosperity in the mining industry.

❋

While complete statistics of European spelter production are not yet available, it is understood that there was probably an increase of about 30,000 tons.

❋

The productions of copper, iron, lead and zinc in the United States in 1912 were in each case the greatest on record.

❋

In 1912 for the first time in history the world's production of copper exceeded one million tons.

❋

The world's production of copper in 1912 was 1,004,844 metric tons, compared to 887,088 tons in 1911.

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The world's production of gold in 1912 was $469,618,083, compared to $459,377,300 in 1911. The world's production of silver was about the same as in 1911.

METAL MARKETS

The metal markets have been fairly active, with no important changes for the week.

Gold, Silver and Platinum

Gold—Prices on the open market in London remain at the bank level, 77s. 9d. per oz. for bars and 76s. 4d. for American coin. Germany was an active buyer, and there was some demand for India.

Iridium—This metal continues in small supply, and $70@75 per oz. is asked for pure metal.

Platinum—The market is still quiet and prices here are unchanged. Dealers ask $45@46 per oz. for refined platinum, according to quantity; $47.50@48.50 per oz. for hard metal, up to 10% iridium. Abroad there is no material change, although the large producers are reported to hold heavy stocks.

Copper, Tin, Lead and Zinc

Silver—There are no new features to record in the silver situation. Market continues steady. Supplies are being distributed naturally, and no speculative operations seem to be under way.

Copper—There have been no further stories about large sales and, in fact, during the last week the market has been distinctly dull. The principal producers have been unable to attract business at their terms, and the smaller ones do not do much at the concessions that they are willing to offer. The aggregate of the sales during the week was but a few million pounds. In the early part some domestic business, prompt delivery, was done at 17⅝c., usual terms, but in the latter part that price was shaded. The prices talked about are not of much signification, inasmuch as a variety of discounts are allowed, terms being gaged according to the needs of the customer. There is a certain eagerness to sell contracts for forward delivery and copper for March has been sold well under 17.40c., New York. Owing to the weaker European market, as expressed in the decline of standard copper in London, European consumers are no longer as enthusiastic as they were last week and have practically withdrawn from the market. The domestic business is practically of a hand-to-mouth character. While there is no pressure on the part of sellers, all orders that present themselves are taken care of at below the prices quoted by the largest interests. A small business in Lake copper was reported. At the close, Lake copper is quoted 17½@17¾c.; electrolytic in cakes, wirebars or ingots, 17.35@17.45c. Casting copper is quoted at 17⅛@17¼c. Apparently there are liberal quantities of this kind of metal for which a market is sought.

As reported above, the London standard market, which was very strong on Jan. 2, being quoted on that day at £77 for spot, and £77 12s. 6d. for three months, has assumed a weaker tone, and gradually declined to £76 for spot and £76 12s. 6d. for three months, which is the close. This weaker tone is ascribed to the liquidation of bull accounts, and outside of this, to bear selling.

Copper sheets are 23@24c. per lb., base for large lots; full extras are charged and higher prices for small quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Exports of copper from New York for the week were 3031 long tons. Our special correspondent gives the exports from Baltimore at 486 tons.

Tin—The statistics published at the beginning of this month showed that visible supplies at the end of 1912 were about 5500 tons smaller than at the beginning of the year. When the London market did not respond by a vigorous advance, as had been expected, to this favorable news, our consumers, who had all along been buyers of future material, withdrew from the market. There is, however, no doubt that with the excellent consumption of the metal in this country, they will reënter the market the moment London starts a further upward movement.

Due to the absence of an urgent demand for nearby metal, the premium for the same has almost entirely disappeared. The market closes steady at £229 5s. for spot and £228 10s. for three months, and about 50⅝c. for January delivery here.

Lead—The market retained its firmer tone, although business at the somewhat higher prices which are being asked by sellers, has fallen off somewhat. The close is to be quoted at 4.15@4.20c. East St. Louis, and 4.30@4.35c. New York.

As a consequence of a falling off in the demand on the part of consumers, the lead market in Europe turned rather weak, reaching its low point on Jan. 6, when it was quoted at £17s. 12s. 6d. Since then, buyers have been attracted by these lower prices, and the market has become firmer, closing at £17 13s. 9d. for Spanish lead and 7s. 6d. higher for English.

Spelter—A number of transactions took place, for January-February metal at last prices. March-April spelter is being offered at a discunt, but not much business has been consummated. We report the market unchanged at 7.05@7.10c. St. Louis, and 7.10@7.20c. New Rork.

The European market is reported as being extremely dull, due to an almost entire absence of demand on the part of consumers. It closes somewhat easier at £26 5s. for good ordinaries and £26 7s. 6d. for specials.

Other Metals

Aluminum—The market continues quiet and steady, with no material change in prices. Quotations are 26@26½c. per lb. for No. 1 ingots, New York. The London quotation is equal to 19¾c. per lb., or slightly above the New York parity.

Antimony—Sales of antimony have been light. Cookson's is unchanged, at 10@10¼c. per lb. For Hallett's, 9⅜@9⅝c. is quoted. Chinese, Hungarian and the outside brands are unchanged, 9@9¼c. per lb. being asked.

Quicksilver—Business has been quiet and prices remain unchanged at $40 per flask at New York, with 59c. per lb. for retail lots; San Francisco $40 for domestic, $37.50 for export orders. London price has advanced from £7 7s. 6d. per flask to £7 15s., with £7 10s. quoted from second hands.

DAILY PRICES OF METALS

NEW YORK

Jan.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St Louis, Cts. per lb.
2	4.8530	63½	17 @17.50	17.40 @17.50	50½	4.30 @4.35	4.15 @4.20	7.10 @7.20	7.05 @7.10
3	4.8580	63½	17 @17.50	17.40 @17.50	50½	4.30 @4.35	4.15 @4.20	7.10 @7.20	7.05 @7.10
4	4.8625	63⅝	17 @17.50	17.40 @17.50	50½	4.30 @4.35	4.15 @4.20	7.10 @7.20	7.05 @7.10
6	4.8625	63⅝	17 @17.45	17.35 @17.45	50⅜	4.30 @4.35	4.15 @4.20	7.10 @7.20	7.05 @7.10
7	4.8625	63⅝	17 @17.45	17.35 @17.45	50¼	4.30 @4.35	4.15 @4.20	7.10 @7.20	7.05 @7.10
8	4.8625	63¼	17 @17.45	17.35 @17.45	50⅛	4.30 @4.35	4.15 @4.20	7.10 @7.20	7.05 @7.10

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. belo w that of electrolytic. The quotations for lead represent wholesale transactionsin the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Silver quotations are in cents per troy ounce of fine silver.

LONDON

Jan.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
2	29 5/16	77	77⅝	82	229½	228⅞	17⅞	26¼
3	29 5/16	76 11/16	77 5/16	81¾	229¾	229¼	17 13/16	26¼
4	29¼	....	....	....	....	....	....	....
6	29 5/16	76½	77	81¾	229¼	228⅝	17⅞	26¼
7	29⅜	76⅜	77	81½	229	228½	17 11/16	26¼
8	29⅜	76	76⅝	81½	229¼	228½	17 11/16	26¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = % 21¾c.

Gold and Silver Production in 1912

By Frederick Hobart

The gold production of the world in 1912 exceeded that of any previous year, according to the preliminary figures so far received, the increase over 1911 having been $10,240,783, or 2.2%. This increase as recorded is owing entirely to the large gain in the Transvaal, which was approximately $18,225,000. All the other African mines—Rhodesia and West Africa especially—showed gains, and the total was sufficient to offset losses in the United States, in Russia and in Mexico. The mines of

TABLE I. GOLD PRODUCTION OF THE WORLD

	1911	1912
Transvaal	$170,059,273	$188,285,000
Rhodesia	12,986,000	13,375,000
West Africa	5,197,488	7,379,000
Madagascar, etc	2,706,639	2,750,000
Total Africa	$190,949,400	$211,789,000
United States	$96,890,000	$91,685,168
Mexico	24,880,100	22,500,000
Canada	9,762,100	11,250,000
Central America, etc	3,399,000	3,450,000
Total North America	$134,931,200	$128,885,168
Russia, inc. Siberia	$32,151,600	$27,750,000
France	1,707,100	1,825,000
Other Europe	2,584,900	2,595,000
Total Europe	$36,443,600	$32,170,000
British India	$11,054,100	$12,908,415
British and Dutch East Indies	4,726,500	4,875,000
Japan and Chosen	6,896,900	7,115,000
China and others	3,769,600	3,750,000
Total Asia, not inc. Siberia	$26,447,100	$28,648,415
South America	$10,421,800	$11,250,000
Australasia	60,184,200	56,875,500
Total	$459,377,300	$469,618,083

Australasia also continued the decrease in production which has now extended over several years. The Asiatic mines generally increased their production, especially those of the Kolar district, in British India, where deeper workings have restored the level, which dropped in two or three of the principal mines in 1909 and 1910. Details concerning the Transvaal, Rhodesia, the more important districts of the United States, Mexico and Canada, are given in the articles which follow.

In Russia the decline was due to labor troubles and scarcity of water in many of the important places, notably those of the Lena Gold Mining Co., which has for two or

TABLE II. GOLD PRODUCTION OF THE WORLD FOR 20 YEARS.

1893	$158,437,551	1903	$329,475,401
1894	182,509,283	1904	349,088,293
1895	198,995,741	1905	378,411,054
1896	211,242,081	1906	405,551,022
1897	237,833,984	1907	411,294,458
1898	287,327,833	1908	443,434,527
1899	311,505,947	1909	459,927,482
1900	258,829,703	1910	454,213,649
1901	260,877,429	1911	459,377,300
1902	298,812,493	1912	469,618,083

three years been the largest producer in Siberia. The decline in Mexico was due mainly to the disturbed condition of the country.

In the accompanying Table I, the returns of the figures for nearly all the important producers are based upon actual returns covering 11 months of the year, December only being estimated. The figures for the United States are the preliminary estimates compiled by the director of the mint from the receipts at the mints and assay offices and the principal refiners. Where it has been necessary to estimate for the greater part of the year a conservative basis has been adopted, and it is believed that the changes made necessary by later returns will not be very large and will be rather in the nature of an increase over the figure given than a decrease.

At the present time, the African continent is the leading gold producer of the world, owing to the extraordinary output of the Transvaal. Africa furnished 45.1% of the total gold production in 1912, the Transvaal alone reporting 40.1% of the total. The North American continent comes second in the list with 27.4% of the total, the United States alone supplying 19.5%. The

TABLE III. UNITED STATES GOLD PRODUCTION
(Value)

	1911	1912
Alabama	$18,335	$17,674
Alaska	16,002,976	17,398,943
Arizona	2,954,790	3,303,504
California	20,310,987	19,988,486
Colorado	19,153,860	18,791,710
Georgia	30,532	9,881
Idaho	1,169,261	1,303,917
Missouri	.....	310
Montana	3,169,840	3,235,287
Nevada	18,968,578	13,331,680
New Mexico	639,877	604,961
North Carolina	76,693	142,760
Oregon	599,235	630,801
South Carolina	13,437	15,587
South Dakota	7,430,367	7,795,680
Tennessee	14,140	9,881
Texas	1,778	10,170
Utah	4,709,747	4,376,971
Virginia	4,300	8,755
Washington	504,537	285,044
Wyoming	18,791	22,884
Unassigned	965,247	.....
Total Continental U. S.	$96,757,308	$91,284,886
Philippines	130,501	400,248
Porto Rico	2,191	.....
Total	$96,890,000	$91,685,134

Australasian production which, at one time, constituted nearly one-third of the world's total, was last year only 12.1%. The causes of this decline are explained by our correspondence elsewhere.

TABLE IV. SILVER PRODUCTION OF THE WORLD
(In Fine Ounces)

	1911	1912
Mexico	79,032,440	76,500,000
United States	60,399,400	62,369,903
Canada	32,740,748	35,250,000
Australasia	16,578,421	17,950,000
Other Countries	36,621,835	37,500,000
Total	225,372,844	229,569,903

Table II shows the course of gold production in the world for 20 years past; an extraordinary record, the production of 1912 having been more than three times as great as that of 1893. The increase during these 20 years has been continuous, with the exception of the three years, 1900 to 1902, during which there was a falling off resulting from the Boer War and the partial stoppage of mining in South Africa. The chief factors in this growth, have been the new developments in South Africa, in Alaska and the Yukon, in the Lena and the Transbaikal districts in Siberia; the advance in gold metallurgy, and the widespread use of the dredge as a chief method of handling gold-bearing gravels.

In 1912, as in the preceding year, we cannot report the opening of any new districts of the first importance. Minor discoveries have been made here and there, but no large new districts like the Yukon have been discovered or opened. Any future increase, so far as can now be predicted, will come from more intensive working and closer saving. Of course, there are possibilities of new discoveries, but the world is coming to be so thoroughly

explored that there are only a few regions through which we can look for such accessions to our gold producers. The Congo Free State in Africa, some parts of South America and the provinces of Manchuria and Mongolia, in China, are regions in which there is still opportunity for much prospective. Some Canadian explorers have thought that the Mackenzie country in the far North of Canada may develop a second Yukon, but there is so far no reliable data on which to base such an opinion.

TABLE V. UNITED STATES SILVER PRODUCTION
(Fine Ounces)

	1911	1912
Alabama	174	237
Alaska	275,691	516,224
Arizona	1,594,428	3,456,989
California	2,737,336	1,255,192
Colorado	7,530,940	8,350,316
Georgia	225	65
Idaho	7,507,802	7,703,721
Illinois	4,648	3,740
Maryland	.....	201
Michigan	507,234	543,360
Missouri	56,228	25,311
Montana	11,116,278	12,338,589
Nevada	10,651,571	13,042,118
New Mexico	1,142,337	1,251,412
North Carolina	2,227	3,783
Oregon	69,116	79,896
South Carolina	.....	40
South Dakota	206,188	200,796
Tennessee	126,683	109,773
Texas	442,486	420,994
Utah	12,679,633	12,795,072
Virginia	45	7,974
Washington	142,196	258,152
Wyoming	1,009	298
Unassigned	3,601,542	.....
Total, Continental U. S.	60,396,017	62,364,253
Philippine Islands	3,383	5,650
Total	60,399,400	62,369,903
Total Value	$32,195,296	$37,942,773

Great as has been the increase in gold production, it has hardly kept pace with the demand for the metal in commerce, and as a basis for the world's credit. At the close of the year there is recorded an urgent demand for gold from the leading financial centers of Europe. Without entering into any discussion on the effect of the large production, we can merely repeat as was said a year ago, that it has been contemporaneous with and one important cause of the great expansion in industry and commerce during the last 20 years.

VI. GOLD MOVEMENT, UNITED STATES AND GREAT BRITAIN

	United States		Great Britain	
	1911	1912	1911	1912
Imports	$52,737,854	$55,151,765	£45,048,881	£47,438,827
Exports	36,188,397	46,768,238	36,423,844	40,9,412
Excess	I. $16,549,457	I. $8,483,627	I. £8,625,037	I. £6,535,415

Table VI herewith shows the imports and exports of gold in the United States and Great Britain for the 11 months ended Nov. 30. The imports of gold into the United States are largely from Mexico, Central and South America, in the form of bullion; while some comes also from Australia in Japan, chiefly in copper and other bullion Australia and Japan, chiefly in copper and other bullion to be refined.

The Silver Market

The silver market throughout 1912 was strong and advancing, with occasional slight reactions only. The average monthly prices advanced from 25,887d. in London and 56.260c. in New York in January to 29.320d. in London and 63.365c. in New York in December; gains of 3.433d. in London and 7.105c. in New York. The average prices for 1912 were 28.042d. in London and 60.835c. in New York; comparing with 24.592d. in London and 53.304c. in New York for 1911. Table IV herewith shows the monthly averages in New York and London for four years past.

II. SILVER IMPORTS AND EXPORTS

	United States		Great Britain	
	1911	1912	1911	1912
Imports	$40,439,844	$44,402,933	£13,173,007	£15,473,591
Exports	59,667,286	64,343,611	15,435,799	14,749,351
Excess	E. $18,227,442	E. $19,940,678	E. £2,262,792	I. £724,240

London continues to be the chief silver market of the world and the basing point of prices. This is chiefly due to its control of the trade with the East, which has not been shaken by any changes in in the courses of trade.

III. EXPORTS OF SILVER FROM LONDON TO THE EAST

	1911	1192	Changes
India	£8,702,500	£11,924,500	I. £3,222,000
China	990,300	1,796,000	I. 805,700
Total	£9,692,800	£13,720,500	I. £4,027,700

Table II shows the imports and exports of silver in the United States and Great Britain for the 11 months ended Nov. 30. The exports from the United States are chiefly to Great Britain, though in 1912 there were considerable sales to France for coinage purposes, the French government buying in this market. Imports are chiefly from Mexico, Central and South America, the silver coming in base bullion and other forms to berefined here.

The market through the year was supported and advanced by the heavy demand from the East, which is the largest purchaser of silver. India increased its takings of silver, notwithstanding its heavy buying o fgold. Table III herewith shows the exports of silver from London to the East, with only two weeks of the year lacking, as given by Messrs Pixley & Abell, of London, who have reported the trade for many years. The larger exports to India were mainly on private account, the Indian government taking no silver for coinage until late in the year. The speculative interest in silver, which was so prominent in London in 1911, was not much in evidence in 1912. It is suspected that the Indian speculators took advantage of the advancing prices to unload at least a part of their holdings; if so, it was done very quietly, and the advance was not checked.

IV. MONTHLY AVERAGE PRICE OF SILVER

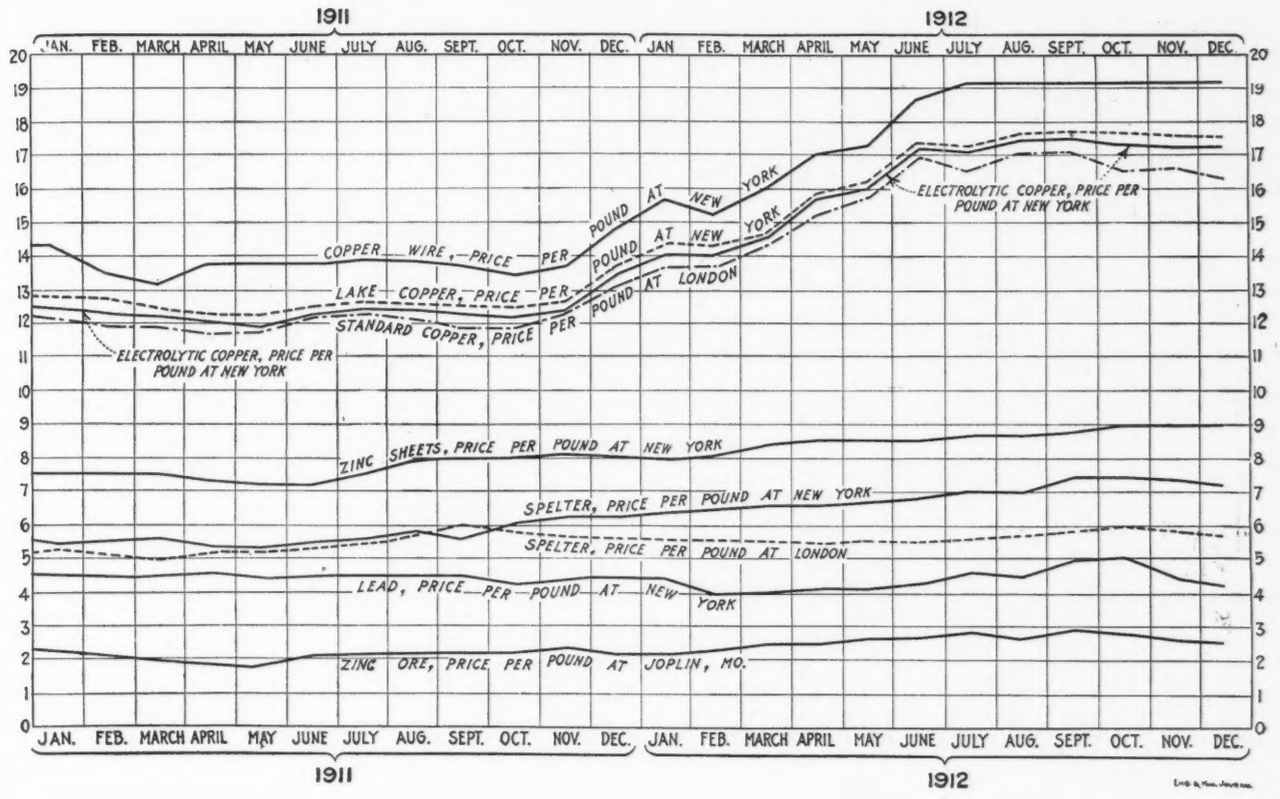
	New York			London		
Month	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	60.654	25.034	24.286	27.919
August	52.912	52.171	61.606	24.428	24.082	28.375
September	53.295	52.440	63.078	24.567	24.209	29.088
October	55.490	53.340	63.471	25.596	24.594	29.299
November	55.635	55.719	62.792	25.680	25.649	29.012
December	54.428	54.905	63.365	25.160	25.349	29 320
Year	53.486	53.304	60.835	24.670	24.592	28.842

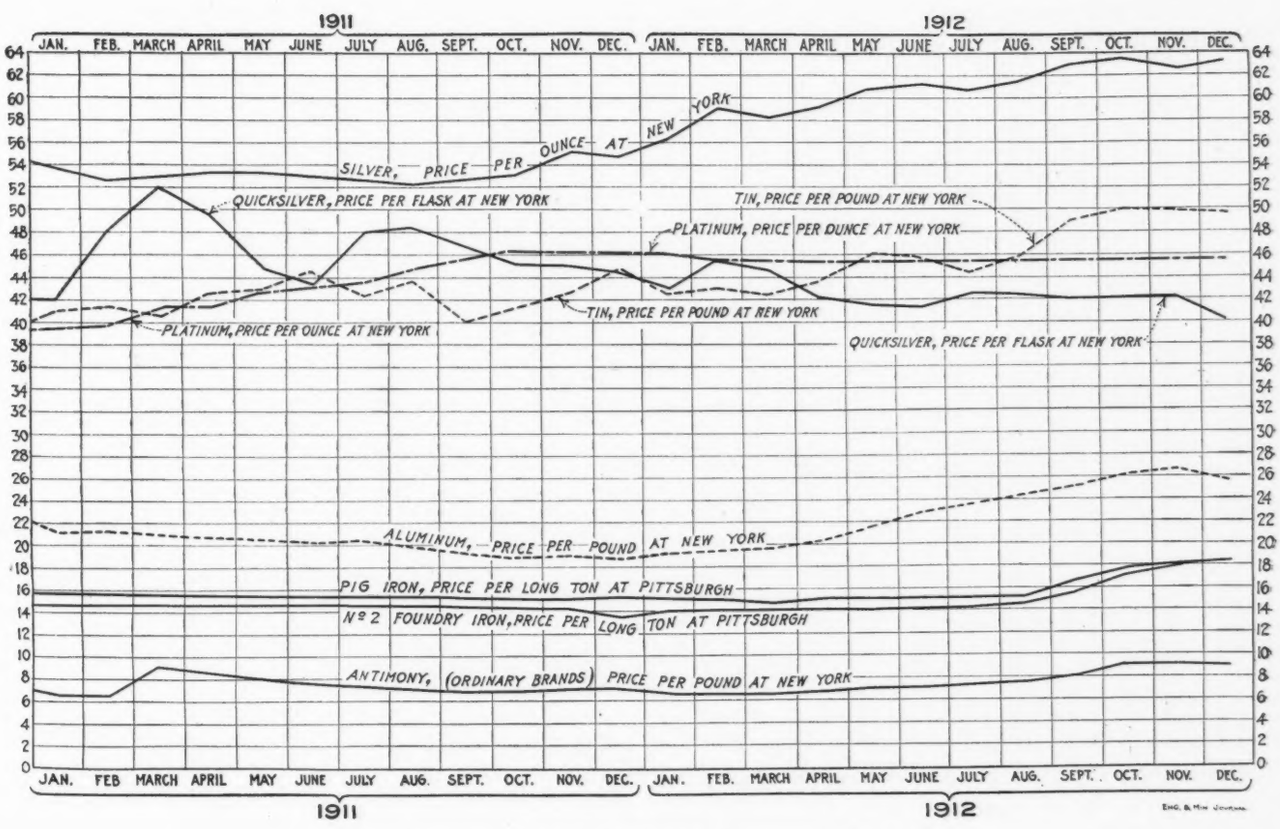
New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

The Indian government in the latter part of the year conducted an unusual operation by purchasing quietly and under cover a large quantity of silver for use in coinage. So adroitly was this done that the market did not suspect what was going on until the shipment was actually made.

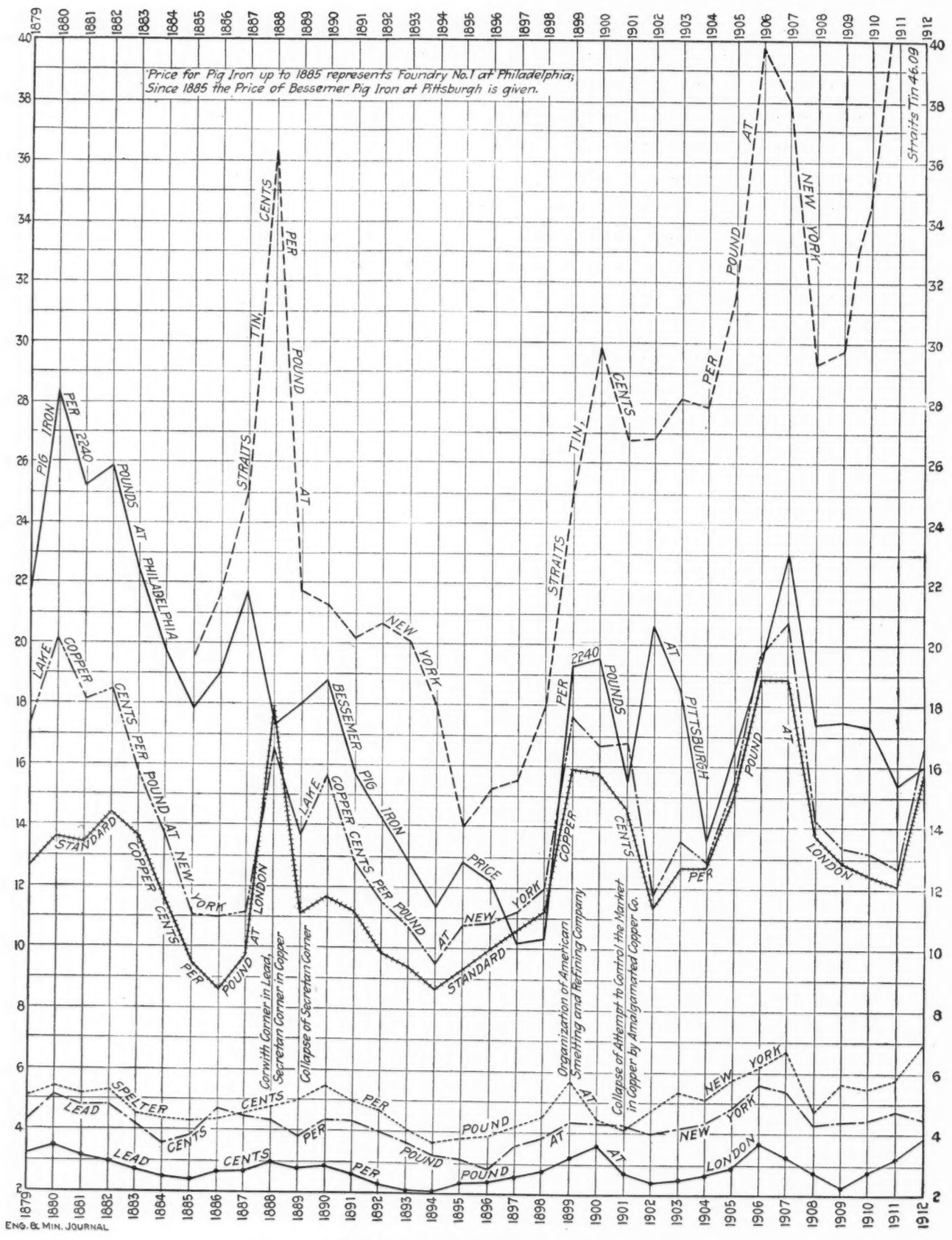
Exports of silver from the United States directly to India and China for the 10 months ended Oct. 31 were valued at $9,296,420, an increase of $746,864 over the previous year.

Coined silver in the United States on Jan. 1, 1913, is estimated as follows: Standard dollars, $565,481,020; subsidiary coins, $174,538,163; total, $740,029,183.


1911
1912
JAN. FEB. MARCH APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
COPPER WIRE, PRICE PER POUND AT NEW YORK
LAKE COPPER, PRICE PER POUND AT NEW YORK
STANDARD COPPER, PRICE PER POUND AT LONDON
ELECTROLYTIC COPPER, PRICE PER POUND AT NEW YORK
ELECTROLYTIC COPPER, PRICE PER POUND AT NEW YORK
ZINC SHEETS, PRICE PER POUND AT NEW YORK
SPELTER, PRICE PER POUND AT NEW YORK
SPELTER, PRICE PER POUND AT LONDON
LEAD, PRICE PER POUND AT NEW YORK
ZINC ORE, PRICE PER POUND AT JOPLIN, MO.


1911
1912
JAN. FEB. MARCH APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
SILVER, PRICE PER OUNCE AT NEW YORK
QUICKSILVER, PRICE PER FLASK AT NEW YORK
PLATINUM, PRICE PER OUNCE AT NEW YORK
TIN, PRICE PER POUND AT NEW YORK
PLATINUM, PRICE PER OUNCE AT NEW YORK
TIN, PRICE PER POUND AT NEW YORK
QUICKSILVER, PRICE PER FLASK AT NEW YORK
ALUMINUM, PRICE PER POUND AT NEW YORK
PIG IRON, PRICE PER LONG TON AT PITTSBURGH
No 2 FOUNDRY IRON, PRICE PER LONG TON AT PITTSBURGH
ANTIMONY, (ORDINARY BRANDS) PRICE PER POUND AT NEW YORK

METAL PRICES IN 1911 AND 1912. MONTHLY AVERAGES


Price for Pig Iron up to 1885 represents Foundry No. 1 at Philadelphia; Since 1885 the Price of Bessemer Pig Iron at Pittsburgh is given.
PIG IRON PER 2240 POUNDS AT PHILADELPHIA
LAKE COPPER CENTS PER POUND AT NEW YORK
STANDARD COPPER CENTS PER POUND AT LONDON
TIN, STRAITS CENTS PER POUND AT NEW YORK
BESSEMER PIG IRON PRICE AT PITTSBURGH
LAKE COPPER CENTS PER POUND AT NEW YORK
STANDARD COPPER CENTS PER POUND AT LONDON
TIN, STRAITS CENTS PER POUND AT NEW YORK
Straits Tin 46.09
LEAD CENTS PER POUND AT NEW YORK
SPELTER CENTS PER POUND AT NEW YORK
LEAD CENTS PER POUND AT LONDON
Corwith Corner in Lead.
Secretan Corner in Copper
Collapse of Secretan Corner
Organization of American Smelting and Refining Company.
Collapse of Attempt to Control the Market in Copper by Amalgamated Copper Co.
ENG. & MIN. JOURNAL

COURSE OF METAL PRICES SINCE 1879—ANNUAL AVERAGES

The Copper Industry in 1912

The production of copper in the United States, Canada, Mexico and Cuba in 1912 and previous years, is given in the following table. Our figures are based uniformly upon reports received from the several producers, who have informed us their output up to the end of November and have given us their own estimate of probable production in December. In many cases, however, the producers have been able to give us their revised figures covering the entire calendar year.

Our statistics represent the smelters' output, which is a different thing either from the mine output or the refinery output. In the case of the Michigan production, however, the smelters are also refiners and their figures for smelting and refining productions are consequently the same.

PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1910	1911	1912
Alaska	5,008,171	19,412,000	33,600,000
Arizona	299,606,971	300,578,816	357,773,703
California	45,793,894	36,806,762	29,867,430
Colorado	10,127,012	8,474,848	6,800,000
Idaho	6,216,461	3,745,210	5,038,000
Michigan	221,400,864	216,412,867	231,629,486
Montana	286,242,403	271,963,769	309,125,000
Nevada	63,877,500	65,385,728	81,816,000
New Mexico	3,632,351	1,518,288	26,174,000
Utah	125,042,381	138,336,905	136,372,157
Washington	.....	.....	1,233,009
East and South	18,195,450	19,656,971	18,915,616
Other States	1,106,525	1,564,207	4,492,623
Totals	1,086,249,983	1,083,856,371	1,242,836,024

PRODUCTION OF COPPER IN NORTH AMERICA

(In Pounds)

Country	1910	1911	1912
United States	1,086,249,983	1,083,856,371	1,242,836,024
Canada	52,492,282	56,370,754	74,244,281
Mexico	137,797,217	136,430,331	158,691,659
Cuba	7,799,764	8,274,563	8,816,241
Totals	1,284,339,246	1,284,932,019	1,484,588,205

REFINERS' PRODUCTION

(In Pounds)

Class	1910	1911	1912
Electrolytic	1,151,624,597	1,156,627,311	1,288,333,298
Lake	221,400,864	216,412,867	231,628,486
Casting	32,193,196	22,977,534	24,777,266
Pig	46,903,463	35,920,626	37,181,237
Totals	1,452,122,120	1,431,938,338	1,581,920,287

SMELTERS' PRODUCTION

(In Pounds)

Source	1910	1911	1912
North American ore	1,284,339,246	1,284,932,019	1,484,588,205
Foreign ore	41,976,733	34,392,091	50,363,284
Scrap	10,962,099	18,529,547	15,713,087
Totals	1,337,278,078	1,337,853,657	1,550,664,576
To foreign refiners	33,855,800	32,413,440	41,837,535
To American refiners	1,303,422,278	1,305,440,217	1,508,827,041
Blister copper imported	146,185,104	146,422,851	(a) 146,000,000
Total crude copper	1,449,607,382	1,451,863,068	1,654,827,041

(a) November and December estimated.

CRUDE AND REFINED PRODUCTION COMPARED (a)

(In Pounds)

	1910	1911	
Smelters	1,449,607,382	1,451,863,068	1,654,827,041
Refiners	1,452,122,120	1,431,938,338	1,581,920,287

(a) Owing to some uncertainty as to the counting of copper regained from scrap, it is unsafe to draw fine deductions from the comparison of figures in this last table.

The progress of copper mining among the several states is in the main reviewed in special articles elsewhere in this paper. Only a few words in explanation of the statistics need be said here. Utah's failure to show an increase was undoubtedly due to the strikes, which, among other things, put the Tooele smeltery out of commission during part of the year. Nevada's big increase may be attributed largely to the inauguration of production by the Mason Valley and Giroux companies. Copper production in California halts because certain important producers continue idle, owing to smoke injunctions, etc. The great increase in production in New Mexico was due to the Chino, but resumption of smelting by the Santa Fé Copper Co. added a little to the total. In Arizona, the Ray and Miami companies both made very large outputs. The older companies did about the same as in 1911. Alaska's great output came chiefly from the Bonanza mine, in the Copper River district.

A noteworthy feature of the reports for 1912 is the appearance of copper from numerous new sources in quantities that are relatively small, but in the aggregate form a considerable total. This is the natural result of the period of high and profitable prices.

The statistics show that the output of American smelters exceed that of the refiners by about 73,000,000 lb., or allowing for the copper passing into bluestone, recovered as a byproduct, by about 65,000,000 lb. In the first half of the year the excess was larger, but in the latter half the refiners made some headway in catching up with the smelters.

STATISTICS OF COPPER

Month	United States: U.S.Refin'y Production	United States: Deliveries, Domestic	United States: Deliveries, for Export	Visible Stocks: United States	Visible Stocks: Europe	Visible Stocks: Total
Year, 1911	1,431,938,338	709,611,605	754,902,233	.....	.....	.....
I, 1912.	119,337,753	62,343,901	80,167,904	89,454,695	158,323,200	247,777,895
II.....	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III....	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV.....	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V.....	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI.....	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII....	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII...	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX.....	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X.....	145,405,453	84,104,734	47,621,342	46,701,374	107,408,000	170,473,587
XI.....	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII....	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	.....	.....	.....	105,312,582	96,857,600	202,170,182

The production of copper sulphate recovered as a byproduct was 39,480,741 lb. in 1912, compared to 33,454,000 lb. in 1911, and 26,356,788 lb. in 1910.

World's Production of Copper

In our compilation of the world's production we base the figures upon crude copper, i.e., the smelters' production, and allocate it according to the country of origin. Thus, Chilean ore is smelted in the United States and

WORLD'S PRODUCTION OF COPPER (a)

(In Metric Tons)

Country	1910	1911	1912
United States	492,712	491,634	563,747
Mexico	62,504	61,884	71,982
Canada	23,810	25,570	33,577
Cuba	3,538	3,753	4,000
Australasia	(b) 40,962	(b) 42,510	46,100
Peru	(c) 40,962	28,500	27,600
Chile	38,346	33,088	35,938
Japan	(c) 50,703	(d) 52,303	54,000
Russia	(b) 22,700	(b) 25,980	35,900
Germany	(b) 25,100	(b) 22,363	23,000
Africa	(b) 15,400	(b) 17,252	20,000
Spain and Portugal	(b) 51,100	(b) 52,878	58,000
Other countries	(b) 28,100	(b) 29,373	31,000
Totals	882,350	887,088	1,004,844

(a) The statistics in this, table are our own compilations, except where specially noted to the contrary. (b) As reported by Henry R. Merton & Co. (c) As officially reported. (d) Privately communicated to us from Japan.

Great Britain, but we credit the copper therefrom to Chile; similarly as to other countries. This method is, we think, both the safest and the most useful, but it is likely to give results that are a little too low.

The figures for 1912 are based upon reports from all the producers, in the cases of the United States, Mexico, Canada and Cuba. The Australian figures represent the copper shipments from that commonwealth. The Peruvian figure is the total of imports into England and France, imports of bars into the United States, and blister copper produced in the United States out of Peruvian ore as reported by the respective smelters treating such ore, plus a small allowance for copper escaping enumeration in this way. The Chilean figure is arrived at in a similar way. The large increase in the production of Chile is attributable to the Braden mine, which produced about 9,500,000 lb. From Japan we have had no good data, but with the general knowledge that there was an increase in the production there, we estimate 54,000 tons. The figures for Germany and "other countries" are similarly estimated. In Germany the principal producer is the Mansfeld company, the output of which varies but little from year to year. For Russia we have the official figures for the first seven months of the year and estimate the output during the whole year as being in that ratio. For Africa we have the exports of the Cape Copper Co. and the blister copper produced in the United States from African ore, these items representing more than half of the total output credited to Africa. Import statistics representing more than half of the Iberian production indicate an important increase in that quarter, and it is reasonable to assume that the production of Spain and Portugal in 1912 was as much as 58,000 tons.

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Electrolytic Refining Capacity

The accompanying table gives the electrolytic copper refining capacity of the United States at the ends of the several years, the figures in most cases being officially reported, and in the remaining cases estimated upon trustworthy data.

The electrolytic-refining capacity of the United States is greater than that of all of the rest of the world combined. We have no precise data for England, France and Japan; the following are memoranda of the plants in some of the other countries:

Australia—There are two electrolytic refineries in this commonwealth, viz., Electrolytic Refining & Smelting Co., of Australia, and the Great Cobar Copper Co. The capacity of the former is about 18,000 long tons per annum. Its production in 1912 was about 16,500 tons. The Great Cobar refinery is said to be producing about 5000 tons per annum.

Germany—There are three electrolytic-copper refineries in Germany, viz., the Norddeutscher Affinerie, which produced 2545 metric tons in 1911; the Hüttenamt Oker, which produced 2029 tons in 1911; and C. Wilhelm Kayser & Co., who produced 1685 tons in 1911. The last concern makes its electrolytic copper from scrap.

Russia—There are two electrolytic-copper refineries in this empire, viz., the Rosenkrantz, which produced 9,713,590 lb. copper in 1911 and the Kyshtym, which produced 7,222,000 lb. in 1911. The Kyshtym production in 1912 is estimated to be about 14,444,000 lb. The Werrch-Issetsker company is reported to be building a refinery.

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The Copper Market in 1912

The year 1912 witnessed a great revival in the copper market. This was due primarily to the increase in consumption, both in Europe and in the United States. In Europe, there had been a steady increase in consumption ever since 1905. The best authorities estimate the European consumption to have been 404,800 metric tons in 1906; 411,600 in 1907; 480,500 in 1908; 452,600 in 1909; 541,100 in 1910; 606,300 in 1911. In the United States, the consumption had reached about 305,000 metric tons in 1906, but in consequence of the panic in 1907 fell off to 229,000 metric tons in 1907. It was only 211,200 in 1908. In 1909 it advanced to 323,300 tons; in 1910 to 342,000; and in 1911 to 326,400.

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES

Works	Location	1910 Capacity, Pounds	1911 Capacity, Pounds	1912 Capacity, Pounds
Nichols Copper Co.	Laurel Hill, N. Y.	*330,000,000	†330,000,000	†330,000,000
Raritan Copper Works	Perth Amboy, N. J.	*310,000,000	*320,000,000	†360,000,000
Baltimore Copper Smelting and Rolling Company	Canton, Md.	*264,000,000	†288,000,000	*312,000,000
American Smelting and Refining Co.	Perth Amboy, N. J.	*180,000,000	†180,000,000	*192,000,000
U. S. Metals Refining Co.	Chrome, N. J.	*180,000,000	*180,000,000	*180,000,000
Balbach Smelting and Refining Co.	Newark, N. J.	*41,000,000	*48,000,000	*48,000,000
Anaconda Copper Mining Co.	Great Falls, Mont.	*65,000,000	*65,000,000	*65,000,000
Tacoma Smelting Co.	Tacoma, Wash.	†28,000,000	†28,000,000	*36,000,000
Calumet & Hecla Mining Co.	Buffalo, N. Y.	*50,000,000	*55,000,000	*55,000,000
Total		1,448,000,000	1,494,000,000	1,578,000,000

*Official figures furnished by the respective companies. †Estimated.

The world's stocks of copper, which had steadily risen from 1906 to 1907, were considerably reduced by the increased European consumption during 1910 and 1911, and at the end of 1911, had receded to about 102,000 metric tons, being approximately one month's supply. The world's production had changed but little since 1908, having been about 849,200 metric tons in 1909; 882,350 in 1910, and 887,088 in 1911.

MONTHLY AVERAGE PRICE OF COPPER

	New York						London Standard		
	Electrolytic			Lake					
Month	1910	1911	1912	1910	1911	1912	1910	1911	1912
January	13.620	12.295	14.094	13.870	12.680	14.337	60.923	55.600	62.760
February	13.332	12.256	14.084	13.719	12.611	14.329	59.388	54.974	62.893
March	13.255	12.139	14.698	13.586	12.447	14.868	59.214	54.708	65.884
April	12.733	12.019	15.741	13.091	12.275	15.930	57.238	54.034	70.294
May	12.550	11.989	16.031	12.885	12.214	16.245	56.313	54.313	72.352
June	12.404	12.385	17.234	12.798	12.611	17.443	55.310	56.365	78.259
July	12.215	12.463	17.190	12.570	12.720	17.353	54.194	56.673	76.636
August	12.490	12.405	17.498	12.715	12.634	17.644	55.733	56.266	78.670
September	12.379	12.201	17.508	12.688	12.508	17.698	55.207	55.253	78.762
October	12.553	12.189	17.314	12.788	12.370	17.661	56.722	55.170	76.389
November	12.742	12.616	17.326	12.914	12.769	17.617	57.634	57.253	76.890
December	12.581	13.552	17.376	12.863	13.768	17.600	56.069	62.068	75.516
Year	12.738	12.376	16.341	13.039	12.634	16.560	57.054	55.973	72.942

New York, cents per pound, London, pounds sterling per long ton of standard copper.

The low price prevailing during these years, the unwillingness of the largest mines to force production upon an overstocked market, and the slowness with which the new porphyry mines could be brought to the point of large output, all contributed to keep the production from increasing more rapidly. During the first nine months of 1911, the market had remained depressed and the price

fluctuated around 12½c., but in the last quarter, deliveries both in Europe and the United States increased largely and the market became buoyant, the price advancing by the end of the year to about 14c. At that time it looked very doubtful whether this price could be maintained for long, as an increased production from the porphyry mines of about 12,500,000 lb. per month was due to make its appearance early in 1912, and the European consumption had been so good for the previous years that a recession was expected. But as usual, the unexpected happened. In the first place, the increased production did not put in its appearance in the form of refined copper available for delivery to manufacturers until the second half of the year. In the second place, the European consumption maintained itself; and in addition to these two developments, a great revival in the American consumption occurred. What with the small stocks on hand at the beginning of the year, the conjuncture of these favorable factors made the market buoyant and strong and gave the copper producers a good year after the five previous bad ones. The average price of electrolytic copper at New York for 1912 was about 16⅜c., compared with about 12⅜c. in 1911.

AVERAGE MONTHLY PRICES OF COPPER MANUAFCTURES

(In Cents per Pound)

	1910		1911		1912	
	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper
January	15.35	18.50	14.06	18.50	15.75	19.50
February	15.25	18.75	13.50	18.50	15.25	19.50
March	14.75	19.50	13.25	18.50	16.03	20.30
April	14.75	19.50	13.75	18.50	17.06	21.50
May	14.10	18.50	13.75	18.50	17.30	21.63
June	14.19	18.50	13.75	18.50	18.68	22.50
July	14.00	18.50	13.90	18.50	19.13	22.50
August	14.00	18.50	13.81	18.50	19.13	22.75
September	14.00	18.50	13.75	18.50	19.13	23.50
October	14.00	18.50	13.50	18.50	19.13	23.50
November	14.25	18.50	13.75	18.63	19.13	23.50
December	14.25	18.50	14.94	19.13	19.13	23.50
Year	14.41	18.69	13.81	18.56	17.96	22.02

Ever since the panic year of 1907, the large stocks of copper in first hands and in warehouse caused consumers to adopt a hand-to-mouth policy and to keep their own supplies down to a minimum. This had the double effect of throwing an extraordinary burden upon the producers, and also of causing them, in dull moments, to become unduly nervous on account of the few sales upon their books. In 1912 the American consumers, of course, were the first to feel the great revival in the demand, which the repression of the after-panic years had prepared. They also saw that the visible supply was down to a very low figure. In consequence, they changed their policy and became large buyers for deliveries months ahead. This it was that gave the market its remarkable stability in 1912, and prevented great recessions in prices during the intervals between buying movements. In previous years, the producers at such times had pressed their copper upon an unwilling market. In 1912, with goodly quantities booked ahead and the prospect of a continuance of heavy consumption assured by the bountiful harvests, they faced these periods of dullness with equanimity.

The year opened with a very heavy buying movement, for deliveries over January and February, at about 14½c., delivered at buyers' works. This was induced by the expectation of a continued decrease in the American stocks on hand. These stocks had come down in November, 1911, from about 135,000,000 lb. to about 112,000,000 lb., and, as expected, the statistics showed that by Dec. 31, 1911, they had receded to about 90,000,000 lb. By the middle of the month, demand fell off. European dealers began to get uneasy, the price of standard copper receded so that arbitrage transactions became profitable, and the stocks of refined copper in European warehouse continued to be drawn upon. The outlook in this country was by no means clear at that time; the level of prices was far better than producers had enjoyed for some years. As a consequence, by the end of January, one of the leading American sellers decided to meet the market and cut the price to 14c. This figure proved attractive, and early in February considerable orders were placed. The statistics for January were unexpectedly favorable, showing the third consecutive monthly decrease in stocks of 23,000,000 lb. and bringing the American supplies down to only one-half month's requirements. First the European and then the American consumers came into the market in a large way. The great increase in demand for manufactured copper in this country had begun to make itself felt, and the American mills for the first time in years felt impelled to buy ahead in a large way. Under heavy transactions prices advanced steadily to 14½c., and continued to rise rapidly until March, at the end of which month 15⅞c. had been reached.

In April, a lull set in, which was natural after the extensive purchases made in the two previous months, but as producers were well booked ahead until July, no such pressure to sell developed as had always made its appearance in previous dull spells since 1907. At this time, sales were made by second hands at less than the prices asked by the principal producers, being in the nature of realizations of speculative profits, but these were readily absorbed.

The London standard market declined under similar realizing sales there, and fell below the parity of the American market for electrolytic, which caused large quantities of refined copper to move out of the English warehouses into the hands of consumers. The London standard market then turned upward again; both European and American buyers came into the market for their June and July supplies, and when strikes broke out at the refineries, it began to look as though the requirements of belated buyers might not easily be met. The buying became heavy and prices advanced rapidly to 16¾ cents.

At the beginning of June it appeared that during May European stocks had been diminished by about 15,000,000 lb., American stocks by about the same amount and that the total visible supply was becoming small. Tremendous orders were placed, covering deliveries as far ahead as September at advancing prices, and 17¾c. was reached. Stocks in this country had dwindled to only 45,000,000 lb., equivalent to only 10 days' supply.

There had been a large amount of speculation in the London standard market and heavy bull accounts had accumulated all the way up to £80 10s. Early in July, when the market stopped rising, there was a scramble to take profits, which quickly brought standard three months' copper down about £6. Of course, this sudden decline scared off the buyers of refined copper, who had not yet entirely covered their early requirements. The large producers having practically sold out for two months ahead, remained quiescent. When some little demand again appeared, it was filled by dealers who arbitraged in standard and could therefore sell over 1c. below the producers' price of 17¾c. By the middle of

the month, the London market had absorbed the realization sales and began to pick up, and the quantities of refined copper held outside of the big producers had been disposed of. This led to a sharp reaction upward and by the end of July, 17¾c. was again the ruling price.

August was a dull month. Few new orders were placed, and such as were given out were taken by the smaller producers at slightly below 17¾c., the price for which the larger ones confidently held. Toward the end of the month their patience was rewarded. Large orders for September shipment were forthcoming from Europe and could be filled only by the leading sellers, the others having previously sold out.

September dragged along with little business placed and everybody expecting further large orders from Europe, as consumers there were known to be poorly supplied. But it was not until the end of September, when strikes at the mines of the Utah Copper Co. again caused apprehension of an inadequate supply, that the European consumer came forward and placed orders for October and November shipment.

The breaking out of the Balkan war in October caused a sharp break in standard to £75 for three months, and again brought London standard below the parity of electrolytic in New York. The large producers being satisfied that their copper would be required, continued to hold for 17¾c. right through November and December, and left the market to the arbitrageurs and the smaller sellers, who sold their copper at around 17½, delivered; the business was principally for export and for early shipment. American buyers held aloof. In the second half of the year, the increase in production from the porphyry mines made its appearance and stocks in America began to increase. Those in Europe, however, continued to decrease, and the year closed with about 25,000,000 lb. less in public stocks than at its beginning.

During the last quarter of 1912, consumers the world over had again begun to reduce their own holdings, and thus the invisible supply at the end of 1912 is, no doubt, smaller than at the commencement of that year. They also had relapsed into a hand-to-mouth policy. Considering these facts, it is evident that as a whole the statistical position at the close of the year was still very good.

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The London Copper Market

SPECIAL CORRESPONDENCE

The year 1912 opened with active copper business at 10s. per ton over the closing prices of 1911, and with increased speculative interest. Standard copper rose on the 8th to £64 5s. for prompt delivery, and £65 for three months'. Further advance was checked by adverse reports from Wall Street, threatened labor troubles at home, and political complications in France. Closing prices, £62 3s. 9d. and £62 18s. 9d. Activity in consuming industries in February was everywhere apparent, but the market was dominated by adverse movements on the Stock Exchange until—on the 6th—prices had drifted down to £61 5s. and £62. Economic conditions then asserted themselves, incoming supplies being readily absorbed and stocks in public warehouses being persistently depleted. Prices advanced in spite of the prospect of a general strike of coal miners, and closed at £64 1s. 3d. and £64 16s. 3d.

In March, the coal strike took effect, paralyzing industry throughout the month. The outlook was further darkened by the continuance of war between Italy and Turkey, and by acute tension between France and Spain over the Moroccan question; and later by rumors of impending coal strikes on the European continent and in the United States. Nevertheless prices advanced, the statistical position of the article outweighing all other considerations. Copper-mining shares also attracted the attention of speculators in both hemispheres. Standard copper closed at £69 10s. and £70 7s. 6d. per ton.

With the termination of the coal strike on April 9, sentiment became increasingly optimistic. American electrolytic copper was sold largely at 16c., producers thereafter holding for a slight advance. Sulphate of copper was in increased demand, and the general expansion of business was abundantly indicated by the aspect of the iron trade. Closing prices were £70 7s. 6d. and £71 3s. 9d. In May, business slackened and prices drooped somewhat under apprehension of unfavorable American statistics, but the latter proved rather encouraging, and by the middle of the month it was apparent that the reserve of the metal in the entire world represented only a month's normal consumption. Consumers and speculators alike hastened to buy, and the volume of business on the Metal Exchange was unprecedented. Standard copper closed at £75 10s. and £76 per ton.

The June market developed some sensational features, statistics prompting an immense volume of business. Transactions on the Metal Exchange totaled during the first week about 21,500 tons, apart from what was bought and sold elsewhere for consumption. Prices advanced till, on June 19, £80 15s. was paid for three months' Standard; American electrolytic meanwhile commanding £82 per ton in Europe, and 17¾c. per lb. in America. A relapse followed on the circulation of an unfounded report, said to emanate from New York, of large hidden stocks in America. Casual holders hastened to sell, thereby forcing down prices some £2 or £3 per ton, but the reduced prices attracted better informed buyers whose purchases steadied the market. Standard closed at £77 11s. 3d. and £78 8s. 9d. per ton.

The bull account having grown to formidable dimensions, the July market was vulnerable to bear attacks, and some remarkable fluctuations ensued, prices falling at one time to £71 12s. 6d. and £72 10s. Industrial unrest, international politics and unsteady share markets contributed to the depression. A sharp rally followed on the publication of favorable American statistics, and prices recovered to £79 and £78 17s. 6d., the slight backwardation being due to the scarcity of warrants for prompt delivery. The month's turnover on the Metal Exchange was computed at 71,000 tons. Closing prices £78 1s. 3d. and £78 5s. per ton.

In August there was much uncertainty for a while concerning political and economic developments in the United States, many leading operators were absent for their summer vacation, and there was general reluctance to deal largely in copper, more especially as American statistics for July disclosed an increase in stocks. Therefore, £77 was accepted at one time for Standard. But expansion of business was manifest in improved railway earnings and heavy distribution of equipment orders; there was improved prospect of peace between Italy and Turkey, and the American Government's report told of

assured crops of unprecedented magnitude. Copper was in immense demand for European consumption, the French government placing large orders; and sulphate was in demand earlier than usual and for long extended periods. All this tended to improve values, Standard at one time touching £80. Closing prices were £79 2s. 6d. and £79 10s. per ton.

The September market was sensitive by reason of the expiration of numerous option contracts, which had been passed early in June, and on which holders desired to secure what little profit remained to them. Sales were pressed accordingly, and prices weakened a little, but the underlying conditions of trade were such as to arrest any serious decline. The standard market was largely divested of its speculative element, but business was exceedingly active as between producers and consumers. Prices closed at the highest for Standard, £79 5s. for cash, £80 3s. 9d. for three months'.

In October, political complications in southeastern Europe produced a general depression which, toward the middle of the month, degenerated into a panic wherein copper suffered with other commodities. Standard at one moment touched £72 and £72 15s. At this tempting level bears hastened to cover recent sales, and a sharp recovery followed. European statistics were favorable, and consumptive demand was large, one feature being the rapid depletion of stocks of refined copper in public warehouses. Prices were carried up to £76 17s. 6d. and £77 15s., but thereafter declined somewhat under pressure of dearer money, political unrest and unfavorable American statistics, closing at £75 7s. 6d. and £76 per ton.

November opened with an improved general outlook, and prices moved upward under brisk covering of short sales and a good volume of business with consumers. The result of the American presidential election removed an element of uncertainty and tended to mature various schemes of electrification and other enterprises which had been in abeyance. Business slackened somewhat durthe second half of the month, chiefly by reason of financial stringency, but leading producers held firmly for their prices, and there was abundant evidence of large prospective requirements. Standard copper opened at £75 10s. cash, and £76 2s. 6d. three months, advanced to £78 10s. and £79 5s., respectively, on the 18th, and closed at £76 7s. 6d. and £77 2s. 6d. per ton.

In December the market was depressed by political complications and rumors of probable war in Europe. Heavy bear operations brought prices down to £73 10s. and £74 10s. on the 16th. At this point there were rumors of sales of standard for shipment to refiners. These and the better demand from consumers raised prices and they closed at £77 12s. 6d. for spot and £77 11s. 3d. for three months.

Copper in Idaho

By Robert N. Bell*

The Snowstorm mine, near Mullan, in Shoshone County, made an output of 74,000 tons of ore. The bulk of it was shipped crude to different copper smelters of the West, by whom it is used as converter lining because of its high silica contents. It carries an average of 3% copper and 5 oz. of silver, in the form of carbonate disseminated through the grains of a hard quartzite. The lower levels of this mine produced finely disseminated chalcopyrite and chalcocite ore. The old leaching plant of this company was transformed into a concentrator, which is now treating 125 tons per day and making a 60% saving, the concentrate running about 25% copper and 27 oz. silver per ton.

A new development was made late in 1912 at the National mine, 1½ miles west of the Snowstorm, in the same series of quartz beds and fractures, that promise to prove of the utmost importance to this locality. The discovery was made at a depth of 1700 ft. through a crosscut 4380 ft. long; it presents a body of disseminated copper-sulphide ore, identical in appearance and value with some of the best sulphide stopes of the Snowstorm mine.

The White Knob mine, at Mackay, in Custer County, owned by the Empire Copper Co., enjoyed a prosperous year. During the greater part of 1912 this property shipped 2500 tons per month of crude ore, which averaged 6% copper and $3.20 gold and silver per ton. Owing to the ore being oxidized, and the fluxing value of its gangue, it is sent to the Salt Lake Valley smelters. Most of this ore was produced by small leasing operations, scattered over the extensive area of this company.

*State mine inspector, Boise, Idaho.

Miami Copper Co. in 1912

By J. Parke Channing*

In 1912 the development of the Miami orebody for mining was extensively carried forward by extending the extraction drifts on the 420-ft. level so as to undercut the main orebody on that level, and also to get underneath the Captain orebody and to connect with the Captain shaft. The development of the 570-ft. level was extensive so as to prepare this level for an extraction level. It is being cut up in the same rectangular-gridiron fashion as the 420-ft. level, and is so arranged that when the final method of mining is determined upon, it will be available for any method selected. The third extraction level was arranged for in the main shaft at a depth of 720 ft., but nothing has been done at this point as it may be advantageous to put this level to a still greater depth, depending upon the ore development.

Of the ore mined in 1912 a large proportion came from development work and from the square sets and slicing. The shrinkage stopes which have been tried out on the 420-ft. level are nearly all in shape, but the work of cutting out with square sets above them and the intervening pillars was not completed. The indications, so far, are that this method of combined shrinkage stopes and pillar slicing will prove to be economical both as regards percentage of extraction and cost.

The early estimates of ore reserves assumed the ore to extend to a depth of only 50 ft. below the 570-ft. level. During the latter part of 1912, eight diamond-drill holes were put down from the 570-ft. level showing that the ore extends in places from 100 to 200 ft. below that level, and in some places the bottom was not reached. The indications are that the ore will go to a much greater depth than was expected, following along the line of the Gila conglomerate fault. The results of 1912 show a material increase in the ore in sight, together with excellent prospects for continuation in depth.

*Consulting engineer and vice-president of Miami Copper Co., 42 Broadway, New York.

In January, 1912, the mill was treating at the rate of 2200 tons per day, and since June 1 at the rate of nearly 3000 tons per day. The approximate production for the year was 32,000,000 lb. of refined copper. The year's work in the mill demonstrated the increased efficiency of the Hardinge pebble mills over the Chile mills, and orders have been placed for Hardinge pebble mills to replace the Chile mills as they are worn out. An extremely heavy type of intermediate 42x16-in. roll developed by the Traylor Engineering & Manufacturing Co., are being introduced, one at a time, in each section of the mill. In addition to this, experiments indicated the desirability of finer crushing of the ore to liberate a certain amount of the mineral which is at present lost in the sand tailing, and these improvements will gradually be installed during 1913. The indications are that with these betterments the capacity of the present mill can be materially increased over its present limit of 3000 tons per day.

In the power house the spaces left for new machinery were filled by the installation of a 600-hp. boiler, a 4000-cu.ft. air compressor, a 1250-kw. generating set, and a second condenser. A second 400-hp. synchronous motor was installed at the Burch pump station, thus giving the pumping plant with its two pumps a capacity of 2400 gal. of water per minute. A tailing elevator was installed below the mill, raising the tailing to a height of 75 ft. and permitting of its discharge in the second gulch beyond the mill. On the surface, a number of houses were built, and a hospital, jointly owned by the Miami and the Inspiration, is now being erected. The work for the year progressed smoothly and the prospects, as above noted, for increased ore reserves and an increased tonnage in the mill are most excellent.

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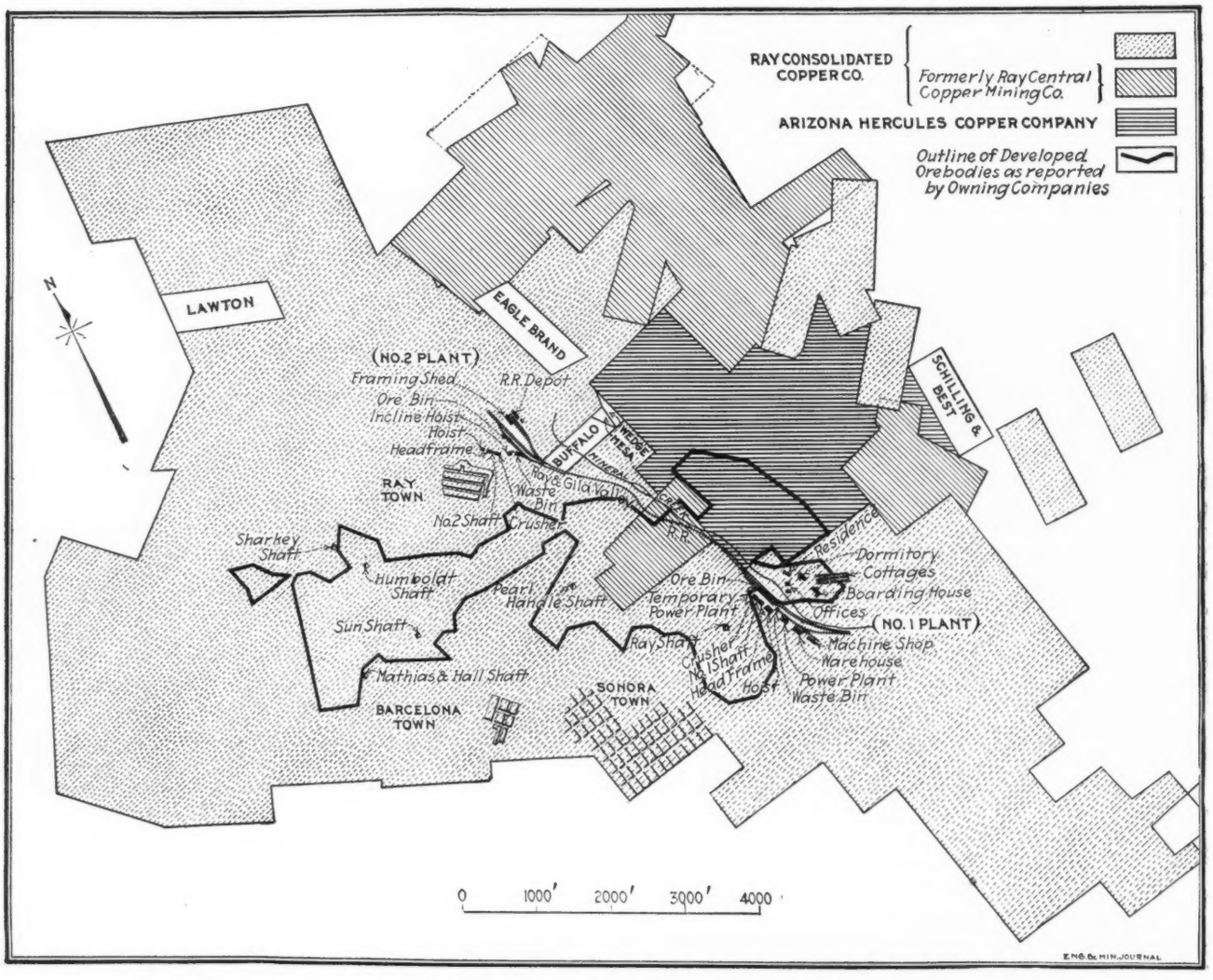
Copper in Arizona

By James Douglas*

Arizona responded to the higher market price for copper prevailing in 1912 by notably increasing her output, both from the older sources and from the mills of the newly developed so called porphyry mines. No discoveries of any note were made, but on the other hand, all the older properties increased instead of depleted their reserves, and introduced improvements in both their mining and metallurgical departments, which will enable them to handle lower-grade ores when necessity forces that inevitable calamity upon them.

The Copper Queen still retains its preëminence with



Ray District, Arizona, with Outline of Orebody Reported by Owning Companies

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an output of 82,138,000 lb. Its neighbor, the consolidated Calumet & Arizona and Superior & Pittsburgh, comes next in the list, followed by the Old Dominion, the United Verde and the Arizona Copper Co. The only new works started in 1912 were those of the American Smelting & Refining Co., at Hayden.

Ore Developments at Depth

A feature of interest in the Warren district was the finding of larger quantities than heretofore of primary sulphides in the limestones below the Carboniferous, even in the Cambrian. They do not constitute large bodies, and have been up to the present accidentally encountered. When their mode of occurrence is better understood they may constitute an important source of supply. A more noteworthy development was made in the exploration of the feldspathic rocks, especially in the prominent mass which composes Sacramento Mountain. These rocks promise to add notably to the life of the district. In the Clifton region a somewhat analogous occurrence took place in the discovery of copper along the line of certain faults to a depth considerably below the zone of secondary enrichment which was assumed to limit the occurrence of profitable ore. In the Globe district good ore was found to extend in depth below the limits at first assigned to it in the Miami, and the development of rich secondary ores down even to the 1600-ft. level of the Old Dominion added to the reserves on that large and persistent vein. The same persistence of ore in depth was realized on the United Verde, so that none of the old standard mines has yet shown the slightest symptoms of decline. On the other hand, no important new mines were opened.

Reverberatory Smelting Replacing Blast Furnaces

Metallurgical activity was in the direction of replacing cupola by reverberatory smelting, owing to the increased quantity of concentrates supplied to the large smelting works. The Miami concentrates, shipped to the Greene-Cananea company's works at Cananea, increased the output of the Cananea smeltery by from 3,000,000 to 3,500,000 lb. of copper per month, bringing the year's output of that establishment up to 75,000,000 pounds.

The Copper Queen put two reverberatories and three roasting furnaces into service for handling the Nacozari concentrates. The Calumet & Arizona company is almost replacing its old works by new construction, largely along reverberatory lines, and the Arizona Copper Co. expects before the close of the year to start its reconstructed works, consisting exclusively of reverberatories. The supply of ore likewise so exceeded the smelting capacity at the United Verde that Mr. Clark is building new works in a more convenient situation. At Globe the old concentrator was found too small, and so defective in construction that it is being enlarged under a better design. The output of the district within a limited number of months will be largely increased by the product of the Inspiration mill, whose concentrates it is currently supposed may be smelted on the spot by the Inspiration company. But this large item of increase will not seriously add to the Arizona product in 1913, though the completion of the Ray mill, and increased activity by the Calumet & Arizona will probably run Arizona's output up to a somewhat higher figure than it has yet reached.

Mining in Butte in 1912

By B. B. Thayer*

There was a marked increase in general activity in the Butte district during 1912, occasioned by the higher prices received for the several metals. All of the companies operated with but few interruptions, and in consequence the metal output was greater than it has been for several years previous.

The Anaconda Copper Mining Co. was busy installing the new system of air hoisting, but it will take another year at least to complete the installation, and not until that time will the full benefits of the change be felt.

The Davis-Daly, East Butte, Butte & Superior and Anaconda, and in fact all of the operating companies, did the usual large amount of development work during the year, and the officials of the several companies expressed themselves as being well satisfied with the results. There are an unusual amount of activity in the eastern end of the district.

Duluth capital is developing a section in the northeastern portion of the district, while the Anaconda company is preparing to explore some of its property lying east of the Pittsburgh & Montana properties, now owned by the East Butte company.

A prophecy was made some years ago that in time Butte would become as important a factor in the production of zinc as it has been in the production of copper, and now it appears likely that the prophecy will be fulfilled. The Butte & Superior company is completing a concentrating plant, situated at its mine, which, according to reports, is effecting good recoveries, and it is stated that the mine is looking exceptionally well, so well, in fact, that an increase of concentrating capacity is contemplated.

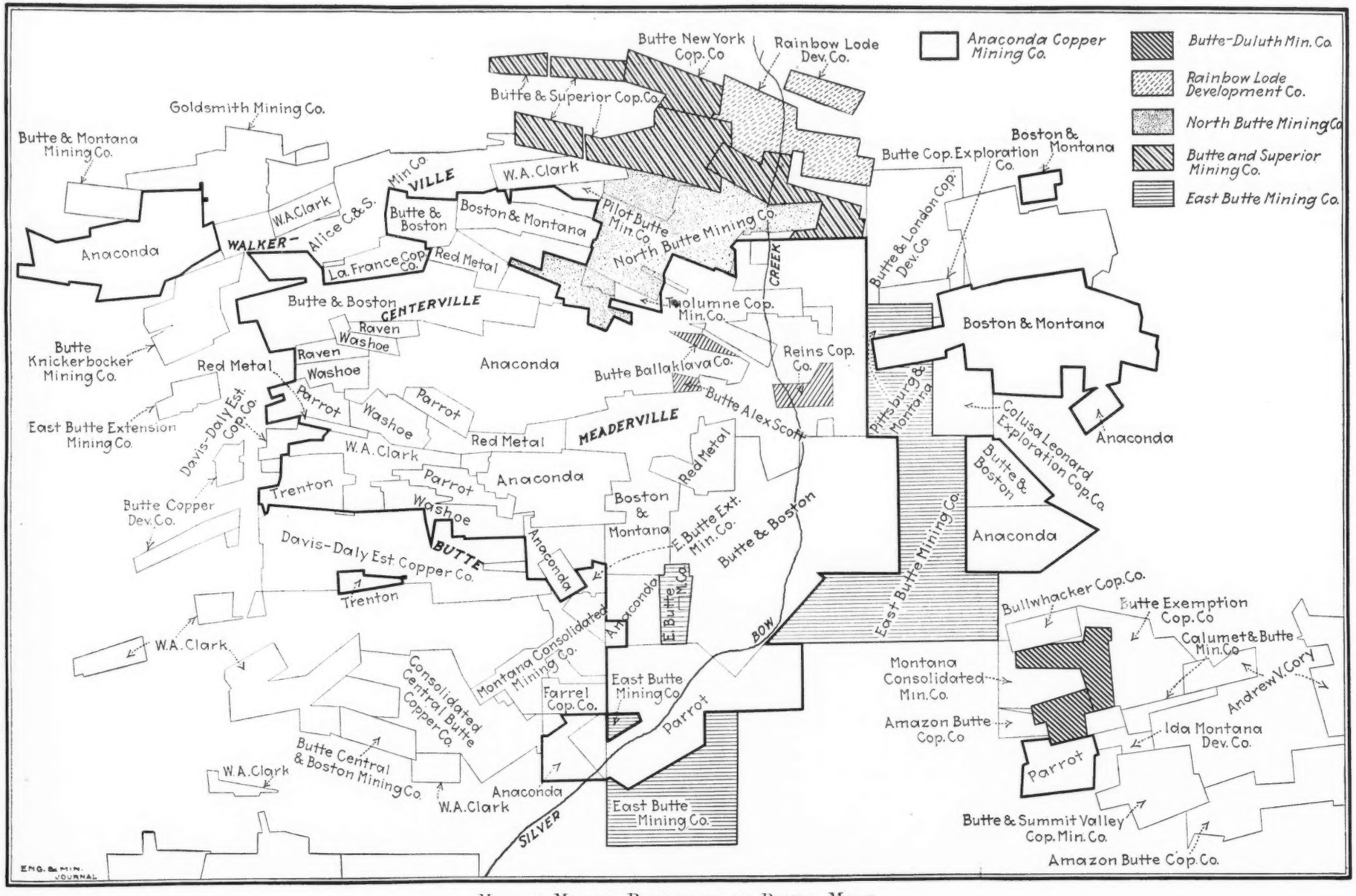
W. A. Clark is erecting a concentrating plant a short distance south of the city of Butte, in which he intends to concentrate the zinc ore from the Elm Orlu mine. The managers of Mr. Clark's property have expressed themselves as being well pleased with conditions in general.

When the concentrating plants mentioned above have been put in full operation, the product from them will prove to be an appreciable factor in the zinc output of this country. During 1912 all of the zinc concentrates produced were shipped to outside points for final reduction, but efforts are being made to perfect a method of reduction which will permit of the final treatment of all zinc ores and concentrates at Butte.

The use of electricity for power has become more general throughout the district, and the Butte, Anaconda & Pacific Ry. is about ready to operate its trains by electric power, thereby effecting a material saving in operating expenses. This is the pioneer movement in railway electrification in the Rocky Mountain districts, but it is almost an assured fact that at least one of the transcontinental railroads will electrify in the near future, at least on the mountain divisions.

The cost of producing copper at all points in Montana increased somewhat during the last six months of 1912, due to an increase in the wage scale which was granted by the several companies on account of the better prices obtained for their output; but the advance in wages was general throughout all the copper-mining regions of the United States.

*President, Anaconda Copper Mining Co., 42 Broadway, New York.



MAP OF MINING PROPERTIES AT BUTTE, MONT.

The Lake Superior District in 1912

By Carl L. C. Fichtel*

The year 1912 was a prosperous one for the Lake Superior district. The price of copper during the greater portion of the year was such that the producing mines were operated at a substantial profit, resulting in an increase of dividends and affording an opportunity for some mines to acquire a surplus.

Wages Increased

Wages on all classes of labor were increased throughout the district about May 1, 1912, but a scarcity of trammers during the summer months materially handicapped some of the smaller outlying properties in increasing production.

One-man drilling machines were adopted at several properties and are gradually supplanting the two-man machines. Considerable attention was given to scientific engineering and greater efficiency was obtained in the various branches of mining. "Dollar rock" was obtained at the South Kearsarge branch of the Osceola Consolidated.

Tube mills for regrinding the tailings were introduced in some of the mills and others made preparations for their adoption. A working man's compensation and employer's liability law went into effect and was universally adopted by the mines. The Sturgeon River Land & Improvement Co. was incorporated and will construct a hydro-electric plant to supply the mines of the district with cheap power.

Large Holding on Ashbed Lode

The Keweenaw Copper Co. acquired about 6000 acres of land on the trend of the Ashbed lode and made an exchange on a stock basis with the Phœnix and Washington companies which will give the combined company a stretch of about 13½ miles on the Ashbed formation. Toward the end of 1912 two drilling outfits were put in commission. A small force of men was employed at the Cliff property and openings were extended on the Kearsarge lode. At the Ojibway, development work was carried on in both shafts. The formation is bunchy and of an unsettled nature. A large stockpile has been accumulated. The five producing Mohawk shafts maintained about normal production, and the rock taken from the openings of the No. 6 shaft was also sent to the mill. Permanent equipment for No. 3 and 4 shafts of the Ahmeek will be ready to go into commission early in 1913. The property maintained its record of low costs and high-grade rock. It is planned to enlarge the stamp mill to meet the increase in production from shafts Nos. 3 and 4. The new steel rock house and enlarged equipment at No. 2 Allouez shaft which went into commission during the summer resulted in increased production. At the stamp mill, owned jointly by this and the Centennial company, two heads were altered.

At the Wolverine mine a slight decrease in the copper content of the rock was experienced for a couple of months, but the company rounded out the year with the mineral yield up to normal.

*Electrical department, Calumet & Hecla Mining Co., Calumet, Mich.

Encouraging Drill Cores at the Mayflower

The Mayflower Mining Co. secured some of the most remarkable drill cores ever taken from the district. The core from hole No. 22 carried copper for practically the entire distance between 1011 and 1133 ft.; 88 ft. of this distance showed an average of 30.8 lb. per ton. The formation is a comparatively soft amygdaloid. The cores taken from holes Nos. 15 and 17, the discovery holes, showed 26 and 32 lb. of copper per ton, respectively. A. L. Dickerman, of Boston, has been in charge of the exploratory work. The Old Colony Copper Co. succeeded in identifying this same formation on its lands.

The shaft on the St. Louis property of the Calumet & Hecla Co. was put down to a depth of about 500 ft. On the conglomerate lode, all the Calumet & Hecla shafts with the exception of No. 12, the most southernly, were operated throughout 1912. The five shafts on the Osceola amygdaloid lode contributed nearly 40% of the rock treated. No. 21 shaft on the Kearsarge lode revealed ground above the average richness for this formation. The company erected an addition to the electric power plant at Lake Linden and started the installation of a 7500-kw. low-pressure steam turbine to utilize the exhaust steam from the stamps. The building for the second regrinding mill was completed and the plant will go in commission in 1913. This mill will contain 64 Hardinge conical mills, together with tables, etc., which are being constructed at the company shops. At the smeltery the new furnace building was nearly completed and the foundations completed for a new electrolytic plant to be ready in 1913. This plant will be used instead of the company's Black Rock plant at Buffalo, N. Y., which will be closed.

Tamarack Shows a Surplus for the Year

The Tamarack Mining Co. did considerable stoping on the Osceola amygdaloid lode; the company showed a surplus for the year. Alterations were made at the stamp mill and a Hardinge conical mill was installed to make an experimental run on the tailing piles. The Osceola Consolidated Mining Co. resumed operations at Nos. 5 and 6 shafts of the main mine; at No. 1 shaft of the North Kearsarge branch a new steel rock house and enlarged hoisting equipment are in the course of erection. The Laurium Mining Co. continued development throughout 1912 on the Kearsarge lode. Preparations were made to resume operations at the LaSalle Copper Co., and shafts Nos. 1 and 2 on the Tecumseh tract were unwatered.

The New Arcadian Copper Co. sunk its shaft to a depth of over 250 ft. and, in cutting a station at that point, opened a copper-bearing lode of promise. Shaft sinking was also done by the New Baltic Copper Co. The shaft of the Oneco Copper Mining Co. passed the 1200-ft. mark; drifts were extended at the several levels.

R. M. Edwards succeeded Stephen R. Dow, as president of the Franklin Mining Co. The new combined air-and-steam-hoisting engine went into commission at the Franklin during the summer. The Quincy No. 9

shaft was arranged to handle a large tonnage and the surface equipment, a duplicate of No. 8, was started. No. 6 rock house was remodeled and increased equipment installed at No. 2 surface plant.

The Hancock No. 2 vertical shaft was sunk to a depth of 4000 ft. A series of copper-bearing formations was cut at various points from 3400 ft. down. A well mineralized formation designated as the foot-wall lode was cut by the crosscut from the 18th level. The surface equipment is complete and the property will enter the producing list early in 1913.

Isle Royale Mill Operating at Capacity

At the Isle Royale, work was done on the Grand Portage lode with encouraging results. A new shaft was started on the main lode and railroad connections were made to afford shipping facilities to the Lake Milling, Smelting & Refining Co. mill, which will handle the increase in production; the Isle Royale mill is operating to capacity. The Houghton Copper Co. sank a winze about 200 ft. deep from the 620-ft. level drift and cut three copper-bearing lodes.

A slight curtailment was made in the rock shipment of the Superior property to the Atlantic mill and attention was given to putting the West lode in shape for production. Sinking was resumed at No. 2 shaft and railroad connections made to permit shipping to the Lake Milling, Smelting & Refining Co. mill. The Baltic company of the Copper Range Consolidated experienced a decrease in the copper content of the rock, but this was probably offset by a betterment in the Trimountain at depth. At the Baltic mill a low-pressure turbine was ordered to furnish electric power; Hardinge conical mills are also to be installed for regrinding the tailing.

Lack of Trammers Handicapped Winona

Production from the Winona mine was increased; the company was handicapped by its inability to secure trammers. The second head at the stamp mill went into commission and Hardinge conical mills were installed.

The North Lake shaft-sinking operations were suspended shortly after the shaft was established in the ledge, pending the delivery of a hoisting engine. The South Lake shaft reached the Butler lode at a depth of about 110 ft. Indiana put its shaft down over 1200 ft. on its way to cut the felsite formation that revealed the remarkable cores about two years ago. The Lake company entered the producing list, sending between 300 and 400 tons of rock daily to the Trimountain mill. Adventure carried on exploratory work during the year. The Mass mill and railroad were overhauled and shipment to the mill aggregating about 700 tons daily was made from the Butler and Evergreen lodes. The No. 6 Victoria shaft was sunk about 1000 ft. Results at this mine were good.

Two Shafts Opened on the White Pine

At the White Pine property of the Calumet & Hecla company two shafts were opened and good ground was developed. The copper is flaky and occurs in a sandstone formation; with improved milling methods it can be successfully treated. The favorable results led to the formation of the Onondago company to develop adjoining land and also to the preparation for resumption of work at the Nonesuch property.

The Sudbury Nickel District in 1912

In the nickel-copper district of Sudbury, Ont., 1912 was marked by increased treatment facilities and by the advent of new interests in the region. The Canadian Copper Co. increased the capacity of its matte smeltery at Copper Cliff to about 2500 tons of ore per day and an early extension of treatment capacity to 5000 tons per day is planned. The company during 1912 drew most of its ore from the Creighton mine, some coming from the Crean Hill and Copper Cliff mines. Exploration of the old Frood mine, now known as No. 3, has practically been concluded, and it is reported that upward of 50,000,000 tons of ore have been opened up by the drills. Plans for the equipment of this mine are under way, designed for an ultimate daily output of 10,000 tons. The orebody is from 200 to 400 ft. thick and lies nearly horizontal 600 to 1000 ft. below the surface. It is reported to run 3.5% combined nickel and copper, more than ½% lower than the district average so far maintained. The company has built a railroad four miles long to connect the No. 3 mine with Copper Cliff. The Strathcona property, in Levack township, was drilled and relinquished. The auxiliary plant at Copper Cliff for the treatment of Cobalt silver ores will be discontinued.

The Mond Nickel Co. has completed its 1000-ton matte smeltery at Coniston, about four miles east of Sudbury, and in December fired the roast heaps at the new plant. Its smeltery, of 300 tons daily capacity, at Victoria Mines, is still operating, but will be abandoned. The company is obtaining all of its ore from the Victoria and Garson mines. At the former an important extension of the orebody at the 1600-ft. level was recently discovered. A 1000-ft. shaft is being sunk on the recently acquired property adjoining the No. 3 mine of the Canadian Copper Co., and preparations are being made to reopen the North Star mine. A small amount of high-grade nickel ore from the Alexo mine, near Porcupine, Ont., was received by the Victoria plant during the year.

The Dominion Nickel-Copper Co., controlled by J. R. Booth, of Ottawa, and M. J. O'Brien, of Montreal, during the early part of the year, purchased the Murray mine from the H. H. Vivian estate, of Swansea, Wales, and the Gertrude, Elsie and Victor mines from the Lake Superior Corporation, of Sault Ste. Marie, Ont. An energetic drilling campaign on the Murray, disclosed a large orebody reported to contain upward of 4,000,000 tons. The company already owned and had extensively drilled several large areas on the North Range and elsewhere in the district. In December it was decided to install a treatment plant, and a site has been selected west of the Murray mine.

Early in 1912, Swedish nickel-mining interests drilled in Levack township, but discontinued work in the spring. A Toronto syndicate also undertook exploration on optional properties, but quit suddenly without obvious reason. The American Smelting & Refining Co. took several options and is now drilling. In December, British engineers inspected, but did not option, several properties.

Generally the district has been more active than for many years, as regards explorations and options on the properties, other than those controlled by the operating companies. The result of drilling during the last three years has been to increase the known ore reserves many fold.

The Production of Lead in 1912

The production of lead in the United States in 1912 and two previous years is given in the accompanying tables, which is a compilation of the reports made to us by all of the refiners, who have estimated their production only for the last part of December. The large increases in the production of desilverized lead was due to the inauguration of smelting and refining by the International company, which put its smeltery into operation in the early part of the year, and its refinery during the later part. Although the refinery had by the end of th year worked up nearly all of the accumulation of base bullion previously made at the smeltery, it is important to bear in mind that a large stock of ore had been accumulated at the smelting works previous to the beginning of 1912.

PRODUCTION OF LEAD IN THE UNITED STATES (REFINERY STATISTICS)

(In tons of 2000 lb.)

Class	1910	1911	1912
Domestic:			
Desilverized	217,490	211,041	239,264
Antimonial	9,098	8,916	10,241
S. E. Missouri	145,387	155,008	146,038
S. W. Missouri	20,728	25,993	22,681
Totals	392,703	400,958	418,224
Foreign:			
Desilverized	90,473	89,487	81,659
Antimonial	4,892	4,929	4,274
Totals	95,365	94,416	85,933
Grand totals	488,068	495,374	504,157

Included in the above figures is 4622 tons of lead whereof the source was dross, scrap, etc., smelted and refined in works whereat the principal business is the treatment of virgin material.

In classifying the lead production of the United States we adhere to our old custom of grouping the smelters of southeast and southwest Missouri, although certain of them desilverize their lead.

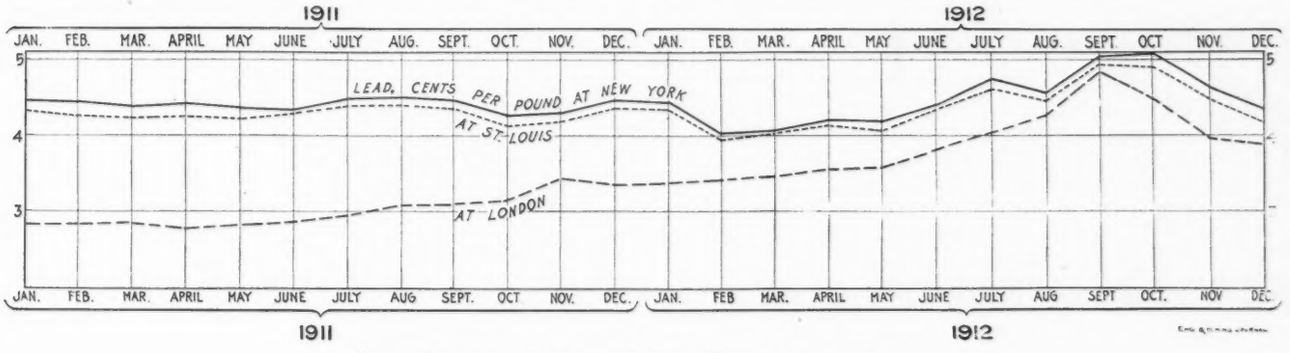
The Lead Market in 1912

While a small increase of lead production occurred in the Cœur d'Alene region, Idaho, and Utah, a considerable falling off of production took place in Missouri, where the output was exceptionally large during 1911. New important sources of supply were not discovered in this country.

A formidable competitor of the American Smelting & Refining Co. for the smelting and refining of lead has arisen in the International Smelting & Refining Co., which commenced operations at its lead smeltery, at Tooele, early in 1912. Its refinery, which is situated at East Chicago, Ind., went into commission toward the latter part of the year.

The year opened with the market quoted at about 4.45c., New York, and 4.32½@4.35c., St. Louis. It remained on that basis until the end of January, when suddenly, on the 30th of that month, the American Smelting & Refining Co. reduced its published quotations by $4 a ton. Naturally, all other sellers of pig lead met these prices, giving the market a rather unsettled appearance, which again found its expression in a further reduction by the principal interests on Feb. 3, of $3, and shortly thereafter another reduction of $2 per ton was made, thus bringing the market to a level of 4c., New York, and 3.85@3.90c., St. Louis. On that basis a large business was done by the A. S. & R. Co., which thus was enabled to move off the largest part of its accumulation, outside sellers not being willing to meet the decline.

On March 19, the market was advanced to 4.10c., New York; and on March 22 to 4.20c., when, through the reluctance on the part of outside sellers to meet these prices and speculative purchases of St. Louis lead, the St. Louis market advanced to the New York level.



LEAD PRICES, 1911 AND 1912. MONTHLY AVERAGES

The market remained stationary until the middle of June, when a very large demand developed, especially for white-lead purposes, and heavy business was placed. On the 12th of that month, the American Smelting & Refining Co. advanced its price to 4.50c., New York. Business continued excellent and a further advance was made on July 3, to 4.75c., New York. At this level outside producers became very anxious sellers, freely cutting prices quoted by the American Smelting & Refining Co. Consequently, the latter was forced, in order not to lose its market entirely, to reduce the quotation, which it

MONTHLY AVERAGE PRICE OF LEAD

	New York			St. Louis			London		
Month	1910	1911	1912	1910	1911	1912	1910	1911	1912
January	4.700	4.483	4.435	4.582	4.331	4.327	13.650	13.009	15.597
February	4.613	4.440	4.026	4.445	4.266	3.946	13.328	13.043	15.738
March	4.459	4.394	4.073	4.307	4.238	4.046	13.063	13.122	15.997
April	4.376	4.412	4.200	4.225	4.262	4.118	12.641	12.889	16.331
May	4.315	4.373	4.194	4.164	4.223	4.072	12.550	12.984	16.509
June	4.343	4.435	4.392	4.207	4.292	4.321	12.688	13.260	17.588
July	4.404	4.499	4.720	4.291	4.397	4.603	12.531	13.530	18.544
August	4.400	4.500	4.569	4.290	4.406	4.452	12.513	14.260	19.655
September	4.400	4.485	5.048	4.289	4.356	4.924	12.582	14.744	22.292
October	4.400	4.265	5.071	4.271	4.139	4.894	13.091	15.332	20.630
November	4.442	4.298	4.615	4.314	4.181	4.463	15.217	15.821	18.193
December	4.500	4.450	4.303	4.363	4.332	4.152	13.197	15.648	18.069
Year	4.446	4.420	4.471	4.312	4.286	4.360	12.920	13.970	17.929

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

did on Aug. 5, to 4½c., New York. At that time a great scarcity of lead developed in the European markets, which in consequence thereof were extremely strong, and advanced by leaps and bounds, so much so that the danger of exports from this country became imminent. Here also the demand remained not only very good, but increased constantly, and on Aug. 26, advances to 4.65c., on Aug. 30 to 4.85c. and on Sept. 9 to 5.10c. were the result. Even at this very high level, no cessation of purchases on the part of consumers was noticeable.

About the end of October and beginning of November, some stocks of lead seem to have accumulated in the West, which, in order to dispose of, the owners were offering at considerable discounts. At that time also the International Smelting & Refining Co. appeared as sellers of lead. The consumption of the metal, as is usual at this season of the year, had become smaller, and thus the offers of this outside lead were not readily taken up. Quotations declined rapidly, being reduced, on Nov. 4, to 4¾c.; Nov. 21 to 4½c., and on Dec. 3 to 4.35c.

The London Lead Market

Prices in 1912 opened fractionally better, and well maintained by reason of the scarcity of available supplies. Business was moderate in volume, and fluctuations narrow. Dealers were alert to secure purchases for extended delivery at the few shillings per ton less than was asked for prompt delivery. Closing prices were £15 10s.@£15 12s. 6d. for Spanish.

Trade requirements being quite up to the normal, and incoming supplies insufficient, values tended upward throughout February. Floods in Spain impeded the loading of vessels, and the arrival of the metal from the mines. Up to £15 18s. 9d. was paid for prompt delivery, but the scarcity was somewhat relieved as the month advanced. Business for forward delivery extended into May. Closing prices were £15 15s.@£15 17s. 6d.

In March, shortage of fuel at the Spanish ports increased the difficulty of engaging freight thence, and the scarcity of lead for early delivery was sometimes acute. A strike of coal miners throughout the United Kingdom tended to restrict consumption, but manufacturers could foresee a large expansion of business and were alert to cover prospective requirements. Fluctuations were unimportant, and closing prices were £16@£16 2s. 6d.

The coal strike and the Easter holidays over, there was an active resumption of business in April, and the market was firm throughout the month, prices advancing gradually, and extra prices being paid occasionally for early delivery. Closing prices were £16 8s. 9d.@£16 10s. for foreign brands, and £16 12s. 6d.@£16 15s. for English.

May business was about normal as regards volume, and with few fluctuations. Toward the close prices stiffened somewhat on the rumor of labor troubles threatening to restrict supplies from North America and from Spain, political unrest in Mexico operating similarly. The close was at £16 12s. 6d.@£16 13s. 9d.

Prices advanced steadily throughout June, an excellent home trade coinciding with speculative enterprise extending some months ahead. All incoming supplies were readily absorbed. Closing prices were £18 2s. 6d.@£18 5s. for foreign, and £18 7s. 6d.@£18 10s. for English.

In July, fluctuations were numerous, but mainly upward. Home trade was intermittent, but continental consumption was brisk and American reports favorable. Labor trouble in the Port of London tended to restrict supply, and some high prices were paid for prompt delivery. The close was at £18 15s.@£18 17s. 6d.

The general expansion of trade was such that incoming supplies of lead were quite inadequate in August, and up to £1 per ton premium was paid in some instances for prompt delivery. Prices advanced generally, closing at £19 15s. for foreign (plus 15s. for early delivery), and £20@£21 for English.

The advance continued in September, and so acute was the scarcity that £23 15s. was at one time paid for prompt delivery. Thereafter, some relief was afforded by supplies arriving, and prices eased accordingly; but European trade demand was sufficient to arrest any important decline. Closing prices were £21@22 for foreign brands, according to time of delivery, and £22@23 for English.

In October, the threatened war in southeastern Europe induced general commercial depression, and its eventual outbreak caused prices to relapse heavily, more especially as supplies of the metal were now coming in abundantly. With transitory rallies prices drifted down to £18 15s@£19 for foreign, and £19 5s.@£19 10s. for English. Consumers operated cautiously in November, and holders had to accept reduced prices which, in turn, revived the demand, particularly for export. Down to £18 was occasionally accepted for early delivery, while £18 12s. 6d. was paid for February and March. Monetary stringency operated in holding prices down, but the intrinsic position of the article was sound, and producers had difficulty in fulfilling their engagements. The close was at £18@18 3s. 9d. for foreign, and £18 7s. 6d.@£18 12s. 6d. for English lead.

In December, consumption demand was good, but the political complications threatened kept prices down and even depressed them a little, though the fluctuations were small. The year closed with £17 17s. 6d. quoted for Spanish lead, with English 5s. higher.

White Lead and Oxides in 1912

The opening months of 1912 did not promise any improvement over the disappointing volume of business in paints during 1911. There was, however, a rapid revival beginning late in March, and trade during the remainder of the year was almost uniformly in excess of that of the corresponding months of 1911. While linseed oil, which is an important factor in the cost of pants, was not so high as it was in 1911, it was still above the average of the last 10 years, but the cost of materials or labor does not appear to have been high enough to put any check upon painting either on old or new work, and the demand for all classes of paints was large.

In spite of continued aggressive competition from the cheaper pigments, the production and sale of white lead show a steady increase which corresponds closely with the growth of the country.

There were 14 "official" price changes made by the smelting companies on pig lead during the year, the lowest price being in February, from which date to early September there was an advance of $22 per ton, the extreme high figure continuing into November, or nearly two months. Since that date the price has declined $15 per ton. The extreme advance was not met by a corresponding rise on any of the lead pigments.

The deliveries of dry white lead during the first half of the year were largely on contracts entered into prior to Jan. 1, at 5@5⅛c. The renewal of these contracts for the last half year was mainly at 5⅜c., but outside of these deliveries new business was at a price more closely approaching the cost of the metal, and at one time as high as 6c. was quoted by corroders. Following the course of pig lead there was a decline during the last two months and at the close contracts for next year are making on the basis of 5¼c. The erratic course of the metal market during 1912 has, however, rendered corroders chary of long-time contracts, and few of them are willing to go beyond four months, which is as far ahead as they can cover.

White lead in oil was quoted at 6¾@7c. per lb. at the opening of the year, but advanced $5 per ton late in June, and another $5 early in July, following the rapid rise in pig lead. With the decline in the latter and a lower price for linseed oil, a reduction of $10 per ton was made in November, and the close is at the opening price of the year, 6¾@7c. The demand for lead oxides from the chief consuming industries was good throughout the year, and prices were steadier than during the two or three preceding years, although the margin over pig lead, taking the whole year through, was close. In litharge the bulk of the business with the heavy consumers was at from 5⅜c. early in the year to 5¾c. toward the close, with 6@6¼c. the prevailing figure during the period of the extreme high prices of pig lead. The closing price is 5½@5¾ cents.

Red lead in the grades most in demand for industrial purposes has ranged from 6¼@6¾c., following the course of pig lead, but in no case fully meeting the advance in the metal.

Coeur d' Alene District, Idaho

The Federal Mining & Smelting Co., the largest producer in the camp, operated the Morning, Mace, and Wardner properties steadily. The Morning mine was made to pay a profit for the first time, and is now undoubtedly one of the great mines of the district. The treatment of the refractory ore has always been a difficulty at this mine, but this has at least been partially solved and the recovery is constantly being improved. A new unit of the MacQuisten tube plant, in which zinc is recovered by flotation, was added to the old unit. The Mace property was greatly benefitted by the purchase of the adjoining claims, in which the ore has been reached at depth, and the reserve here was greatly increased. The ore as found at depth proved to be much richer than that higher up. The Wardner property increased its production and by new installations for the treatment of the ore was able to treat a remarkably low-grade material at a profit.

The Bunker Hill & Sullivan Co., the largest producer of the district, has a great tonnage of ore developed. The new unit of the mill was put in successful operation and the production greatly increased. Several leases were given by this company in some of its old upper workings which proved extremely profitable to both the company and the lessees. The most successful were the Tyler, the Sierra Nevada and the Stemwinder.

The Hercules, Hecla, and Hunter properties produced large tonnages steadily. The Hercules company started work on the lower tunnel at Burke to open the ore at a great increase of depth. This work is being continued by extending the old Humming Bird tunnel on which the company has a lease. The Hecla company was so successful in 1912 that the regular monthly dividend was materially increased. The Hunter company entirely remodeled its mill and increased its capacity.

The Stewart and Caledonia companies reached ore through the long tunnels and have proved ore at depth. The Stewart found a large orebody and is operating the leased mill at Wallace at full capacity. The company built a gravity tramway to bring the ore to the railroad. The Caledonia company is practically closed down on account of litigation. The Tamarack & Custer company has finally settled its internal difficulties and is preparing for active operation. It has leased the aërial tramway from the Rex company and is putting it in shape for operation. Shipments are now being made and will be greatly increased in the near future. Development work is going on and a large tonnage of ore is already developed. The Interstate-Callahan company has opened rich ore and is shipping regularly. A mill is now being built. The Amazon-Manhattan and adjoining property was recently taken over by the Interstate-Callahan.

There are many properties which are hardly out of the prospect stage, such as the Anchor, Oreano, Alice, Puritan, Copper King, La Clede, Terrible Edith, Idora and Sunset, which worked and shipped ore occasionally. Several properties made more frequent shipments, such as the Jack Waite, Black Horse, Monarch and Bear Top.

The labor conditions throughout the district were excellent. The only unfortunate features at present are the several litigations which are under way in the Wardner field between the Bunker Hill and Caledonia, the Stewart and Ontario, and the Stewart and Bunker Hill. All these are over the question of extralateral rights. The Caledonia property is the only one which shut down on account of the litigation.

Other Idaho Districts

By Robert N. Bell*

In the Gilmore district, in Lemhi County, the Pittsburgh-Idaho and the Latest Out mines continues a steady monthly production of about 3500 tons of crude ore, containing 30% lead and 12 to 15 oz. silver. These mines are developing in a satisfactory manner in their deeper levels, which are now only 600 ft. deep, and still in completely oxidized ore. A half-dozen leasing and development enterprises on other properties in this district made small ore shipments during the year.

Other interesting sources of lead-silver ore are being developed in Bonner County. The Idaho-Continental mine, within three miles of the Canadian line, was financed in 1912, and is now being equipped with a concentrating mill of 300 tons daily capacity. This property has a measurable ore reserve amounting to 175,000 tons, containing 14% lead and 5¾ oz. silver per ton. A new road has been completed to the mine from Port Hill, on the Great Northern R.R. This road is 24 miles long and has been built on a maximum grade of 4%, with the idea of equipping it as a light railroad in the future. A new

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800-hp. hydro-electric plant is being installed near the mine, and the company expects to have the mill in operation by next June.

Near the south end of Bonner County, within 1½ miles of the Northern Pacific R.R., at Clark's Fork, the Lawrence mine has been equipped with a concentrating mill of 50 tons daily capacity. This property has a series of seven parallel veins, the smallest of which, about 3 ft. wide, has been cut and drifted upon at a depth of 300 ft. This lead-silver concentrating ore, of about 10% grade, will supply the present milling capacity for some time, while the main tunnel, which will intersect the larger veins at a depth of over 1000 ft., is being pushed ahead.

The new 100-ton mill of the Wilbert Mining Co., at the Dome district, in Blaine County, which was completed last June, has not given satisfaction, because of the extremely fine-grained galena, which leads to excess of slimes. Recent adjustment in this mill, it is believed, will overcome this difficulty.

The Idaho Mining & Smelting Co., of Princeton, Ill., under the management of R. T. Tustin, took over the extensive properties of the Clayton Mining & Smelting Co., at Clayton, Custer County, during the summer of 1912. In addition to new development in the mines, a 100-ton smelting plant was put into successful operation, and it is now producing rich silver-lead bullion at the rate of 80 to 100 bars per day.

Southeastern Missouri

By H. A. Wheeler*

The output of the southeastern lead belt of Missouri in 1912 approximated 145,610 tons of pig lead (the December production is estimated), valued at about $13,000,000. This establishes a new high record for this premier district, as it exceeds the 1911 output by over 5% and the prior banner record of 1910 by over 4%.

St. Francois County the Main Producer

Little prospecting was done in 1912. The agitation about polluting streams with the mill slimes subsided, as the community promptly rallied to the defense of the mine operators when it was recognized that it meant killing the goose that was laying the golden eggs. Boston capital has at last taken an active interest in this disseminated lead belt and will soon have a promising producer.

The St. Joseph Lead Co. produced the largest output in its history, which was derived from five mines at Bonne Terre and Leadwood; the Crawley and Gumbo mines were not operated. The original or No. 1 mine, at Bonne Terre, which exceeds 1½ miles in length, was recently connected by a 7x12-ft. drift with No. 7 mine, about ¾ mile distant. This will enable the output of No. 7 mine to be brought to the mill shaft by the underground haulage system and avoid taking it over a high hill by a switchback. The No. 1 mill, at Bonne Terre, which is about 30 years old and has a capacity of 1500 tons per day, is being remodeled to increase its output. The Bonne Terre and Leadwood power plant will be increased by 1250- and 1000-kw. turbo-generators, respectively.

The smeltery at Herculaneum, which has four large rectangular water-jacket stacks for ore smelting and two round water-jacket furnaces for matte smelting, has been equipped with a baghouse to handle the fumes from the four Dwight-Lloyd sintering roasters.

The Doe Run Lead Co., closely affiliated with the St. Joseph company, broke the high production record of 1911. The ore was produced from five mines and was mainly milled at the new or No. 3 mill, at Rivermines. The old or No. 1 mill, at Doe Run, built 25 years ago, was finally abandoned. The new mill has a capacity of 2500 tons per day, which is being increased to 4000 tons by adding two more sections.

The Desloge Lead Co. pursued its policy of quietly pushing lead production, and no important construction work was attempted in 1912. Its 1500-ton mill was supplied by three mines, but most of the concentrates were shipped, as it only operated its four small Flintshire furnaces.

The St. Louis Smelting & Refining Co., branch of the National Lead Co., operated its plant in the Flat River district. The ore was supplied by four mines, the No. 5 mine not being operated. The mill has been remodeled and its capacity increased to 2000 tons per day. The Huntington mills have been replaced by rolls for regrinding the middlings and the Frue vanners have been superseded by additional Overstrom tables, for which the feed is graded into four classes. The Leyner drill was recently given a thorough trial and the results were so satisfactory that it is being adopted.

The Federal Lead Co., although the youngest of the active producers in the district, maintained the prestige of being the largest individual producer, and its output again made a new record. This is largely due to its leasing and operating the old Catherine mine, in Madison County. The 4000-ton mill at Flat River, the largest in the district, was steadily operated on ore from seven mines in the immediate vicinity. The daily mill capacity was increased 800 tons in 1912 by adding three more Hancock jigs, while two large jaw crushers and coarse rolls were replaced by two Symons gyratory crushers and four Symons disk crushers. A small magnetic separating plant was added to recover clean zinc and copper concentrates, as byproducts, from the lead middlings.

The new Boston company opening on the Jake Day tract on Big River is the St. Francois Lead Co. A shaft was sunk 430 ft. on the river bluff and a spur is now being built to it, from the Leadwood branch of the M. R. & B. T. R.R. The ore will be shipped to the National mill, where sampling arrangements are being provided to take care of it. Ore shipments will probably begin early in 1913.

Madison County

The famous Mine La Motte property contributed its usual quota of lead in 1912, in spite of having been a producer for over two centuries. Its modern production is derived from the deeper disseminated deposits that are found underlying or adjacent to the shallow diggings. This mine now produces 2500 to 3000 tons per year. The smeltery has not been operated for several years, and the concentrates, assaying 65 to 68% lead, are shipped to the Pittsburgh district.

The Catherine mine, opened in 1897, was leased by the Federal Lead Co., the mill was overhauled and remodeled and the mine is again an active producer, the concentrates being shipped to the Alton, Ill., smeltery. The property of the Northamerican Lead Co., at Fredericktown, is still in the hands of a watchman.

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The Zinc Industry in 1912

The production of spelter in the United States in 1912 increased enormously over 1911, and was the largest ever recorded. The details of the production are given in an accompanying table, which is based upon reports received from all of the smelters, who in some cases reported their output up to Dec. 15 with their own estimate of probable production during the remainder of December, and in other cases reported by telegraph after the close of the year. The statement of the stock on hand at smelting works at the close of Dec. 31 is the sum of the reports communicated by the smelters by telegraph after the close of the year. As usual, we include in our report of the production all of the spelter made by smelters whom we class as "ore smelters." Some of these, especially in Illinois and vicinity, smelt more or less dross and galvanizer's skimmings along with ore. Their product is, however, marketed as virgin spelter, and is properly reckoned as such.

PRODUCTION OF ZINC
(In short tons)

	1910	1911	1912
Colorado	6,564	7,477	8,705
Illinois	79,570	88,681	94,886
Missouri and Kansas	112,182	106,173	110,724
Oklahoma	34,760	46,333	77,524
East	43,989	47,172	56,083
Total	277,065	295,836	347,922

The stock of spelter on hand at smelters' works at the end of 1912 was 4264 tons, against 9323 tons at the end of 1911, and 23,000 tons at the end of 1910. Probably there was also on hand at the end of 1912 a small stock of imported spelter, but the quantity of this cannot have been of any material consequence.

Besides spelter, American zinc smelters in 1912 produced 533 tons of commercial zinc dust.

The statistics for 1912 show that in spite of the threatened shortage of natural gas in Kansas and Oklahoma, the production of the smelters in those states has not yet suffered. The nervousness pertains rather to what is expected to happen than to what has already transpired. Most of the smelters in these states are in trouble over their gas supply, and continue their operations only with difficulty and at great increase of expense. One of them, the Lanyon Starr Smelting Co., of Bartlesville, Okla., has already suspended operations, or nearly so. However, the passing of the gas smelters will probably be gradual and long drawn out, just as was the experience in Indiana in the '90s.

The smelting capacity of the United States at the end of 1911 and 1912 is given in another table, which shows an increase of about 15,500 retorts. Certain of the smelters let some of their furnaces go permanently into disuse, thereby reducing the capacity of their works. On the other hand, certain smelters made great increases, especially the Bartlesville Zinc Co., in its works at Collinsville, Okla., the Grasselli Chemical Co., the New Jersey Zinc Co. in its Palmerton plant, and the Tulsa Fuel & Manufacturing Co., at Collinsville, Okla.

The only new works that went into operation in 1912 was the Hillsboro plant of the American Zinc, Lead & Smelting Co., which started in November with 1600 retorts. The plant of the Robert Lanyon Zinc & Acid Co., 1600 retorts, also at Hillsboro, Ill., was not completed in 1912, but is expected to be early in 1913. Including this, 10,392 retorts were in course of construction at the end of 1912, this number comprising 4560 at Depue, 1800 at Danville and 2400 at Hillsboro. It will be observed that all of the new construction is now going on in Illinois. The large additions to the works at Depue and Danville probably will be ready at an early date, inasmuch as they are being made at the works of going concerns, which always is easier than in the erection of entirely new plants. Probably there will be no further additions of consequence to the works of the gas smelters in Kansas and Oklahoma. The question of prime importance is whether additions in Illinois will be made with sufficient rapidity to offset the disappearance of smelting capacities in Kansas and Oklahoma. Anticipating the failure of its gas supply at Bartlesville, the National Zinc Co., on Jan. 1, 1913, took over the works of the United Zinc & Chemical Co., at Argentine, Kan., and Springfield, Ill., under a long lease.

In spite of the enormous domestic production of spelter, it was necessary to import spelter from Europe. During the first 10 months of 1912 there was an importation of 7215 tons, compared to only 1336 tons during the corresponding period of 1911. The total importation in 1912 probably exceeded 10,000 tons, further large quantities having been brought in during November and December. The exportation of domestic spelter during the first 10 months of 1912 was 6509 tons, against 4856 tons during the corresponding period of 1911. The total production of bonded spelter in 1912 was 11,835 tons, of which 8700 tons were exported. During the year it became profitable to enter bonded spelter for consumption, and by the end of the year certain smelters, who previously had been smelting in bond had ceased to do so.

ZINC SMELTING CAPACITY OF THE UNITED STATES.
(Number of retorts at end of years).

Name.	Location.	1911	1912
American Zinc, Lead & Smg. Co.	Hillsboro, Ill.	.....	1,600
American Zinc, Lead & Smg. Co.	Dearing, Kan.	3,840	3,840
American Zinc, Lead & Smg. Co.	Caney, Kan.	3,648	3,648
Bartlesville Zinc Co.	Bartlesville, Okla.	5,184	5,184
Bartlesville Zinc Co.	Collinsville, Okla.	3,200	8,064
Chanute Zinc Co.	Chanute, Kan.	1,280	1,280
Kansas Zinc Co.	Altoona, Kan.	3,840	3,300
Kansas Zinc Co.	Gas City, Kan.	(a)2,560	(a)2,560
Kansas Zinc Co.	La Harpe, Kan.	1,856	640
Collinsville Zinc Smg. Co.	Collinsville, Ill.	(b)1,536	1,536
Edgar Zinc Co.	St. Louis, Mo.	2,000	2,000
Edgar Zinc Co.	Cherryvale, Kan.	4,800	4,800
Granby Mining & Smg. Co.	Neodesha, Kan.	3,840	3,840
Grasselli Chemical Co.	Clarksburg, W.Va.	5,760	12,672
Grasselli Chemical Co.	Meadowbrook, W.Va.	3,456	
Hegeler Bros.	Danville, Ill.	1,800	1,800
Illinois Zinc Co.	Peru, Ill.	4,640	4,640
Lanyon-Starr Sm. Co.	Bartlesville, Okla.	3,456	3,456
Matthiesen & Hegeler Zinc Co.	Lasalle, Ill.	4,380	5,256
Mineral Point Zinc Co.	Depue, Ill.	4,520	4,520
National Zinc Co.	Bartlesville, Okla.	4,256	4,256
Nevada Zinc Co.	Nevada, Mo.	(c)648	(b)648
New Jersey Zinc Co.	Palmerton, Penn.	2,892	5,772
Pittsburg Zinc Co.	Pittsburg, Kan.	448	910
Prime Western Spelter Co.	Gas City, Kan.	5,384	4,834
Sandoval Zinc Co.	Sandoval, Ill.	896	896
Tulsa Fuel & Manufacturing Co.	Collinsville, Okla.	3,320	6,232
United States Zinc Co.	Pueblo, Colo.	1,680	1,920
United Zinc & Chemical Co.	Springfield, Ill.	3,680	3,200
		87,800	103,304

(a) Inactive. (b). Inactive during latter part of year.
(c) Not operating in 1911, but preparing for production in 1912.

The principal supplies of zinc ore in 1912 continued to come from the Joplin district of Missouri, from the Wisconsin district, from Leadville, Colo., and from Butte, Mont. The conditions of mining in most of these districts are treated in separate articles elsewhere in this issue. Butte did not make so great an increase in output as was expected, owing to delays in the new mill of the Butte & Superior Copper Co. Leadville shipped about 137,000 tons of calamine averaging about 30% zinc, as

compared with about 84,000 tons in 1911. Calamine ores were in strong demand during 1912, because of the trouble at the gas smelters, less gas being needed in the smelting of these ores, which do not have to be roasted, than in the smelting of blendes. During the latter part of 1912 smelters were willing to take calamines at a margin of $13@$15 a ton, when on blende they wanted $20 and more. Barring the gas troubles, conditions were favorable to the smelters throughout the year, smelting margins being very good on the whole, and many of the smelters realized handsome profits.

A considerable output of zinc ore came from southwestern Nevada, where the Yellow Pine and Potosi mines were important producers. Arizona, New Mexico and Utah also shipped a good deal of zinc ore. A moderate tonnage came from the old Cerro Gordo mines in California. In the South there was but little gain in output in 1912, either in Virginia, Kentucky or Tennessee, but beginning with 1913, important things are expected of the Holston River district in Tennessee, where the American Zinc, Lead & Smelting Co. is engaged in developing what is believed to be a large deposit of zinc ore of relatively high grade as compared with the ore of the Joplin district. This development has greatly stimulated prospecting elsewhere in that district.

The Spelter Market in 1912

It is necessary to go back to the time when the supply of spelter was chiefly derived through importations from Europe to find a period when prices on an average ruled as high as the level at which business was done during the greater part of 1912. A number of causes contributed to this result, chief of which was a remarkable increase in the consumption of spelter, particularly for galvanizing purposes. The statistics for 1911 showed the stock of spelter carried over into 1912 to be unusually low. Consumers, as a general rule, had been pursuing the policy of supplying their wants ahead to the extent of not more than 30 to 60 days. Smelters thus finding themselves sold up for the near-by months were in the market as sellers for deliveries for which there was no active inquiry. In consequence, belated buyers for early shipments could only cover their wants at a decided premium. This premium at times assumed considerable proportions, particularly when the spelter available to supply the spot demand could only be furnished by speculators, who were not slow to take advantage of the situation.

The general tendency as between early deliveries and late deliveries, as illustrated in the foregoing, governed the market for the greater part of the year. The position ultimately became so strained, due to the fact that domestic consumption had outrun the production, that prices advanced to a level which made importations of foreign spelter possible, and the arrivals of this spelter during the last quarter of the year tended to ameliorate the tense position of the market. The quantity imported up to the end of 1912 amounted to about 10,000 tons, but it is reported that actual purchases have exceeded this tonnage, so that some deliveries of spelter from Europe will fall into the new year.

At the beginning of January, 1912, prices stood at 6.10@6.25c., St. Louis. An extraordinary demand developed, which carried the market by the middle of March to 6.50@6.80c., St. Louis. The wide spread indicates the difference in the price between early and late shipments. The smelters only benefited by the premium realized for early shipments to the extent of the small reserves which they are wont to hold back from their current output in order to protect against unforeseen contingencies. It goes without saying that the conditions which existed, with alternating periods of amelioration and aggravation, were only possible in a market entirely bare of stocks. Reports of a sharp drop in the foreign market, for which there was no adequate explanation, and the end of which could not then be foreseen, produced an unsettling effect. Smelters, being anxious to sell against their ore receipts, tried to force the market, but fortunately for them buyers withdrew for the deliveries which the smelters had available, and the only effect was to shake out such spelter as had been held back for near-

MONTHLY AVERAGE PRICE OF SPELTER

	New York			St. Louis			London		
Month	1910	1911	1912	1910	1911	1912	1910	1911	1912
January.....	6.101	5.452	6.442	5.951	5.302	6.292	23.350	23.887	26.642
February....	5.569	5.518	6.499	5.419	5.368	6.349	23.188	23.276	26.661
March.....	5.637	5.563	6.626	5.487	5.413	6.476	23.031	23.016	26.048
April.....	5.439	5.399	6.633	5.289	5.249	6.483	22.469	23.743	25.644
May.....	5.191	5.348	6.679	5.041	5.198	6.529	22.100	24.375	25.790
June.....	5.128	5.520	6.877	4.978	5.370	6.727	22.094	24.612	25.763
July.....	5.152	5.695	7.116	5.002	5.545	6.966	22.406	25.056	26.174
August.....	5.279	5.953	7.028	5.129	5.803	6.878	22.800	26.801	26.443
September...	5.514	5.869	7.454	5.364	5.719	7.313	23.165	27.750	27.048
October.....	5.628	6.102	7.426	5.478	5.951	7.276	23.900	27.256	27.543
November...	5.976	6.380	7.371	5.826	6.223	7.221	24.083	26.975	26.804
December...	5.624	6.301	7.162	5.474	6.151	7.081	24.019	26.849	26.494
Year.....	5.520	5.758	6.943	5.370	5.608	6.799	23.050	25.281	26.421

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

by shipment, resulting in a decline to about 6.25@6.40c. early in April. The market, however, was very much stronger than it looked, and changed front as soon as a steadier tone made its appearance in Europe. The buyers who had been holding off pending the removal of the uncertain factors came in with a rush, and without practically any setback prices climbed up until 7c., St. Louis, was reached toward the end of July.

The volume which the demand assumed was surprising. New production did not develop as fast as had been expected. The conviction gained ground that the smelting capacity was likely to be diminished by troubles in the gas fields about as rapidly as it increased in the coal fields. The failure of the gas supply in the Kansas and Oklahoma fields had been hanging over the market for some time. Smelters were forced to extend their pipelines and to use oil in order to maintain their operations, and in consequence the smelting cost was materially increased. While in Kansas the gas supply had been more or less intermittent for some time previous, the trouble in Oklahoma confronted the market more suddenly. During the preceding winter, the public service corporations had been drawing very heavily on the field, from which the smelters derived their gas supplies. When spring came, it was found that the pressure had been reduced to such an extent that the supply from this section was bound to show a decided shrinkage in a relatively short time. The Oklahoma smelters have now been forced to great expense to replenish their failing gas fields, but with the exception of one of the plants in Bartlesville succeeded in maintaining operations throughout 1912. A realization of this situation made sellers more conservative, particularly in the matter of disposing of their product at a heavy discount for future delivery.

After a short interim in August, when prices reacted slightly, due largely to realization of some speculative holdings, the market again resumed its advance, until the high point of the year was reached in September, when quotations ruled at 7.35@7.45c., St. Louis. It became evident then that the output, although going on at a very heavy rate, was not adequate to take care of the consumption, which latter was greatly accelerated through the remarkable prosperity in the iron and steel trade, as well as the resumption of activity in all of the brass mills of the country at a rate which had not prevailed since 1906. Fortunately, the position in Europe made it possible to import spelter, as otherwise the market would have passed entirely beyond control and reason. Due to these imports, the premium for early shipments gradually diminished and the market assumed a more normal aspect. A gradual decline set in and at the close of 1912 prices are steady at 7.05@7.10c., St. Louis.

In spite of the trouble of the various smelters in the gas field, the output of spelter shows a remarkable increase, to which reference is made in another column. The mining of zinc ore has been greatly stimulated, and there promises to be a large addition to the output during 1913, particularly from Montana. Meanwhile, the smelters in the coal field are building new furnaces, and plans are pending to move the operations of a number of the gas smelters to the coal fields. The situation as it exists at present is not natural and therefore cannot last. Sooner or later the gas will become too costly, the supply too uncertain, and the struggle for it must be given up. All those concerned in the smelting of zinc ore in the gas fields are fully alive to the situation, and while during the next year or two a state of transition will prevail, which may at times work hardship, a replacement of their industry on a more permanent basis will be taken in hand with the usual American enterprise and energy.

The London Spelter Market

The market in January opened at £26 15s. per ton for ordinary brands and so remained till Jan. 24. Consuming industries were fully employed, but requirements were covered, and producers having sold well, were not pressing sales. This inaction prompted some dealers to shade prices, £26 being ultimately accepted for delivery extending into April, earlier delivery commanding higher prices. Closing quotations were £26 for ordinary brands, and £27 5s. for Silesian specials.

A fractional decline in February was followed by a rapid recovery due to shortage of supplies, prices ranging from £26 2s. 6d. to £26 15s. according to time of delivery, and with fair demand from the home trade. A threatened strike of coal miners then made buyers cautious, but continental demand kept the market steady, closing at £26 5s.@£26 10s. for ordinaries, £27 7s. 6d. for specials.

In March the coal strike greatly curtailed business throughout the month, and prices weakened under pressure from sellers outside the Producers' Syndicate. The latter then made a drastic cut of £2 per ton, whereupon consumers bought largely. A subsequent advance of 5s. was also paid, and all offers thereat were absorbed, delivery extending into May. The close was at £25 5s.@ £25 10s. for ordinaries, £26 5s. for specials.

The coal strike ended, and with great expansion in the iron trade, spelter was in constant request in April, and second-hand supplies were quickly cleared. The Producers' Syndicate made successive moderate advances in prices, which were readily paid. Closing prices were £25 15s.@£25 17s. 6d. for ordinaries, and £26 10s. for specials.

In May consumption continued everywhere active, and business in fair volume. The London quotation was depressed by sale of speculative holdings, down to £25 12s. 6d. and so closed, with £26 10s. for specials.

June prices remained practically unchanged in London, all incoming supplies being quickly absorbed for consumption, while continental prices advanced. Ordinary brands closed at £25 12s. 6d.@£25 15s.; with £26 10s. for specials.

In contrast to other metals, spelter experienced a quiet market throughout July, consumers having already covered their requirements, and producers having sufficiently sold their output. American consumption expanded largely, fully absorbing the native production and threatening to invade European supplies. The London quotation was somewhat nominal, closing at £25 12s. 6d. @£26 for ordinaries; £26 10s. for specials.

Official statistics testified to the large expansion of the galvanizing industry, and trade in sheet zinc was increasing rapidly in August. Second-hand spelter was soon bought up, and values thereafter advanced with business extending in some cases up to the end of the year. Ordinary brands closed at £26 10s., with £27 5s. for specials.

Industrial activity in both hemispheres resulted in brisk September business and for very extended delivery, and producers were constrained to advance their prices twice. The London quotation advanced proportionately, closing at £27 10s. for ordinary brands; £28 5s. for specials.

In October hostilities in southeastern Europe, and consequent depression in the Stock Markets, disturbed trade generally; but spelter remained unaffected by politics or finance, so evenly balanced were supply and demand. The closing prices of September ruled throughout.

In November dealers made gradual concessions which, later in the month, reduced the London quotation far below that for which producers were holding. The event of the month was on Nov. 26, when the Producers' Syndicate made a drastic cut of £1 15s. in the price. Thereat consumers were alert to cover their requirements, and a large business resulted, quickly followed by an advance of 5s. per ton, whereat also large business was done. Ordinary brands closed at £26 2s. 6d.; with £26 17s 6d. paid for specials.

December saw rather a quiet but steady market. Consumption continued good, and the possibility of exports to America was also considered. In the later days of the month some weakness developed, and closing quotations were £26 7s. 6d. for ordinary brands; £27 for specials.

One Zinc Mine in Kentucky, in the vicinity of Marion, shipped in 1912, about 500 tons of blende, the ore being sufficiently free from spar to permit a readily marketable concentrate to be produced by jigging. However, a considerable pile of middlings is being made. Two mines produced small quantities of calamine ore. Probably this kind of ore may receive some serious attention during 1913.

Joplin District Made a Record Output

By Jesse A. Zook

The year 1912 closed with a remarkable record of output. Shipments of zinc sulphide and silicate ores marked an increase of more than 35,000 tons over 1911 and 8000 tons over any preceding year. Starting with an average output in January of 3840 tons, the tremendous growth of the zinc industry brought the year to a close with an output around 7000 tons per week. The firm demand that kept zinc prices on a high level created this situation and caused the disbursement of $5,000,000 more dividends than in 1911. This record seems sufficient proof that the Joplin district has ore reserves and can increase its production when prices insure a profit. As the deepest operating level is less than 300 ft. below surface, and as drill records show ore occurring at lower levels, it is evident that only the upper levels have been developed.

TABLE 1. JOPLIN DISTRICT ORE SHIPMENTS IN POUNDS, 11 MONTHS, 1912

District	Zinc Sulphide	Zinc Silicate	Lead	Comb. Value
Webb City-Carterville	206,293,180	.....	48,333,260	$6,955,218
Joplin	108,804,390	.....	12,023,600	3,343,750
Alba-Neck	34,021,500	174,090	1,193,130	1,007,786
Duenweg	33,453,880	1,213,080	2,794,020	1,003,614
Oronogo	20,299,470	.....	3,080,170	557,665
Carl Junction	13,776,980	.....	122,580	390,278
Cave Springs	12,312,850	.....	772,170	352,190
Carthage	6,020,170	36,480	.....	156,934
Sarcoxie	1,420,360	384,600	.....	44,883
Jasper Co	436,402,780	1,808,250	68,318,930	$13,812,318
Granby	6,339,730	17,492,790	702,900	439,725
Spurgeon	4,348,150	10,570,700	1,979,850	335,020
Jackson	11,579,210	.....	786,790	325,355
Wentworth	3,241,530	297,590	.....	89,260
Saginaw	.....	88,890	11,610	1,675
Newton Co	25,508,620	28,449,970	3,481,150	$1,191,035
Aurora	2,189,070	2,624,200	82,310	96,953
Stott City	817,340	.....	.....	19,726
Lawrence Co	3,006,410	2,624,200	82,310	$ 116,679
Green Co	3,675,270	.....	507,410	117,765
Galena	33,997,550	119,770	5,601,460	1,081,775
Lawton	3,343,360	.....	193,840	92,308
Badger	419,940	.....	17,640	10,387
Cherokee Co	37,760,850	119,770	5,812,940	$1,184,470
Miami	17,087,940	.....	7,843,460	627,486
Quapaw	2,251,940	.....	2,020	54,848
Ottawa Co	19,339,880	.....	7,845,480	$ 682,334
Murray Co	33,180	.....	.....	830
Missouri	468,593,080	32,882,420	72,389,800	$15,237,797
Kansas	37,760,850	119,770	5,812,940	1,184,470
Oklahoma	19,373,060	.....	7,845,480	683,164
11 mo. Total	525,726,990	33,002,190	86,048,220	$17,105,431
Dec. Approx	47,000,000	3,000,000	8,000,000	1,475,000
District Total	572,726,990	36,002,190	94,048,220	$18,580,431
Total 1911	502,542,050	36,113,710	91,185,340	13,431,367
Increase	70,184,940	.....	2,862,880	5,149,064
Decrease	.....	111,520	.....	.....

At the beginning of the year the average price of all grades of zinc ore—sulphide and silicate—was $42.16. At the end of June the average had advanced to $53.90, and at the close of September to $60.40, from which point there was a decline to an average of $55 in December, the year's average being $12 per ton above that of 1911.

Missouri yielded an increase of 34,540 tons of sulphide and 410 tons of silicate. Kansas increased its sulphide output by 1830 tons, but its silicate diminished by 15 tons. Oklahoma's output increased by 400 tons of sulphide, but decreased 9 tons of silicate.

In Jasper County, all points except Sarcoxie reported increased tonnage of sulphide ore, with an increase of silicate from Sarcoxie and Alba-Neck and a decrease from all other points—a net increase of 33,239 tons of sulphide and a decrease of 1334 tons of silicate for the county. In Newton County, Granby, Wentworth and Spurgeon yielded increased silicate, and Wentworth and Jackson increased sulphide production, a net increase of 1298 tons sulphide and 1830 tons silicate for the county.

Purchasing ore on a contract basis was very satisfactory to the purchasers in 1912, but decidedly less so to the sellers, and it has grown in disfavor. The feature that caused the most dissatisfaction was the bartering of the contract ore on the open market by the purchasers when the margin between the contracts and the open market was $6 to $8 per ton in favor of the smelters, thus affording a club to control the open-market level of prices.

TABLE II. PRICES OF ZINC AND LEAD ORES IN JOPLIN DISTRICT IN 1912

	Zinc		Lead	
	High	Aver.	High	Aver.
January	$50.00	$43.72	$62.00	$59.14
February	51.00	42.83	58.00	55.73
March	58.00	48.36	57.50	54.45
April	59.50	50.36	57.00	54.19
May	61.50	52.99	56.00	52.14
June	62.00	54.39	58.50	54.53
July	66.50	56.32	61.00	58.85
August	65.50	54.21	62.00	57.68
September	67.00	57.17	68.00	61.30
October	65.00	56.36	68.00	64.01
November	61.00	54.14	62.00	57.28
December	61.00	55.00	52.00	50.00
1912	$67.00	$52.15	$68.00	$56.60
1911	51.00	39.90	64.00	56.76
Increase	16.00	12.25	4.00	.....
Decrease	.....	.....	.....	0.16

A large portion of the increased tonnage of the year was produced by improved milling practice, and by the installation of additional jigs and slime tables, which raised the percentage of saving. Remodeling and increasing capacity was thus a more potent factor than the erection of new mills. About 20 completely new concentrating mills were erected, about half of which are producing successfully. At least two of them were erected over phenomenal deposits of sulphide ore, milling 150 tons of concentrate from 1500 tons of crude ore per week, a 10% product.

TABLE III. ORE PRICES IN JOPLIN DISTRICT (12 Years)

Year	Zinc Ore		Lead Ore	
	High	Aver.	High	Aver.
1901	$34.00	$24.21	$47.50	$45.99
1902	42.00	30.33	50.00	46.10
1903	42.00	33.72	60.50	54.12
1904	53.00	35.92	62.00	54.80
1905	60.00	44.88	80.00	62.12
1906	54.00	43.30	87.00	77.78
1907	53.50	43.68	88.50	68.90
1908	47.00	34.36	66.00	54.66
1909	55.00	41.08	60.50	54.56
1910	52.00	40.42	58.00	51.98
1911	51.00	39.90	64.00	56.76
1912	67.00	52.15	68.00	56.60

The production of lead ore showed a slight increase in Missouri and Oklahoma and a light decrease in Kansas, a net district gain of 1430 tons. The average price for the year was within a few cents of the average of 1911. Within the year, the Webb City smeltery was sold, ostensibly to the American Metal Co., and a harmonious purchasing alliance was made with the Hammer Bros. at Galena, Kan., and the Picher Lead Co. in Joplin, each becoming a subsidiary of one holding company. The Granby Mining & Smelting Co. lost its smeltery at Granby by fire, and no plans for reconstruction have been

approved. The large stock of lead ore this company had on hand was sold to the St. Louis Smelting & Refining Company.

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Zinc Mining in Wisconsin in 1912

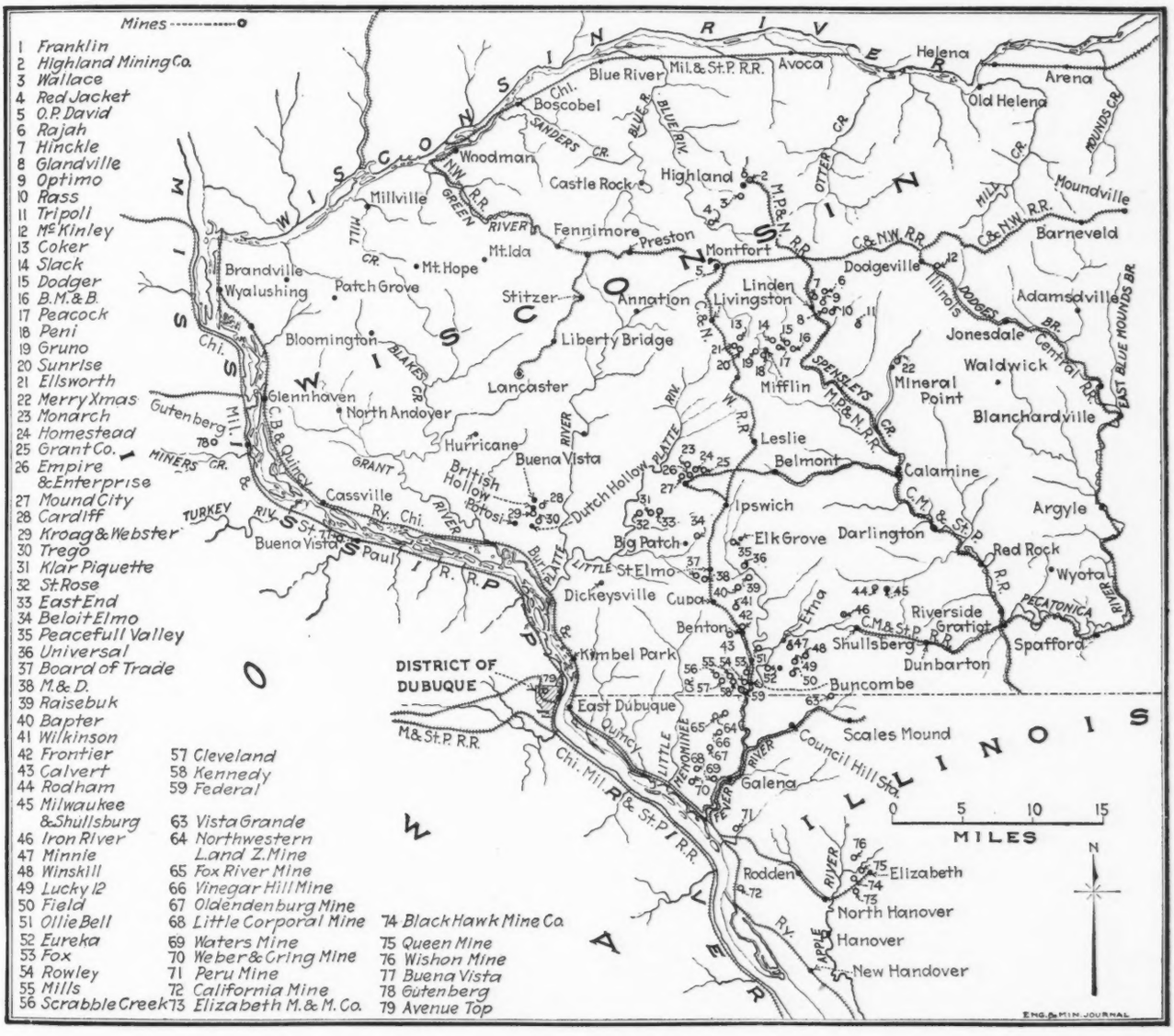
By J. E. Kennedy*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in the first 11 months of 1912 was 184,382,190 lb., an increase of 46,050,701 lb. over the corresponding period of last year. The gross tonnage from mines was 223,615,310 lb., of which amount approximately 8,000,000 lb. was carbonate ore. The tonnage of lead ore shipped was 7,491,160 lb., a decrease of 555,105 lb., while the shipments of sulphur ore, 35,834,450 lb., showed an increase of 9,379,210 lb. The accompanying table gives the shipment by camps for the first 11 months of 1911 and 1912.

The year 1912 recorded the highest level of prices ever attained for zinc ore. The base price of 60% zinc ore steadily advanced from $44 per ton at the beginning of the year to $60 per ton at the end of July. The market then weakened somewhat, as it usually does at that time of the year, and the base price fluctuated between $52 and $62 per ton during the remainder of the year. The highest premium price paid was $64 per ton.

New Development

High prices and good profits stimulated prospecting in all parts of the district. A large number of abandoned mines were reopened and leased lands were redrilled. Shullsburg showed the largest increase in ore production due to the large consistent output of the Winskell mine, owned by the Wisconsin Zinc Co. The Crahall mine, operated by the Field Mining Co., in the New Diggings Township, developed a lode of high-grade zinc ore, turning out raw concentrates assaying over 55% metallic zinc. At Platteville the East End mine proved to be a continuation of the Klar-Piquette range and made quick



Zinc Field of Southwestern Wisconsin

*Platteville, Wis.

return to the Wisconsin Zinc Co. of the purchase price of $75,000. At Hazel Green the big run of the Cleveland mine was struck ahead on the Scrabble Creek leasehold by the Vinegar Hill Zinc Co. The Frontier added another big mine in the Hird property at Benton. A number of good drilling prospects were proved up at Platteville, Benton, Cuba City and Shullsburg. Ten concentrating mills and one roasting plant were constructed and rebuilt during the year. The Interstate Light & Power Co. extended its power transmission lines throughout the district.

SHIPMENTS OF ZINC ORE IN POUNDS.

	Gross From Mines		Net to Smelteries	
	1911	1912	1911	1912
Highland	9,079,730	7,755,500	8,610,430	7,570,900
Linden	15,449,482	14,262,130	753,150	2,075,000
Harker	7,058,880	12,045,490	6,814,410	7,892,540
Mineral Point	2,285,359	1,214,530	35,002,319	36,609,700
Dodgeville	260,910	1,390,930	260,910	1,390,930
Montfort	2,865,060	2,104,160	1,008,120	1,299,160
Livingston	11,532,780	17,414,850	285,000	665,000
Rewey	5,650,540	2,357,000	1,391,000	2,166,000
Platteville	26,958,570	27,722,130	33,833,390	23,897,790
Cuba City	3,692,990	6,561,150	2,818,700	9,358,100
Benton	47,674,050	44,255,870	11,957,510	29,921,120
Hazel Green	36,231,420	32,488,900	10,042,220	16,266,500
Shullsburg	9,067,800	24,030,800	1,478,220	21,346,900
Galena	18,450,220	30,011,870	24,076,110	23,922,550
Totals	196,257,791	223,615,310	138,331,489	184,382,190

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Lead and Zinc Mining in Colorado

By George E. Collins *

The high prices ruling for zinc ores in 1912 permitted the shipment of larger tonnages, especially from Leadville. Elsewhere the high price was not taken advantage of fully, mainly because of the small size of most of the individual deposits, which do not warrant the provision of the elaborate and expensive dressing and separating plants necessary to make marketable products from the complex sulphide ores characteristic of large areas in Colorado.

The shipments of zinc-carbonate ore from Leadville continued, and the favorable market conditions rendered possible the mining of a grade of ore as low as 25% or even 20%. This was really the salvation of the district, which otherwise, since the closing of the down-town mines in the winter of 1907-8, would have been decadent. In the course of mining and prospecting for zinc carbonates, the production of other ores was naturally indirectly stimulated. The Wolftone and Maid of Erin maintained a large production, while the Iron Silver was also active. The mines tributary to the Yak Tunnel also contributed largely to the output.

Apart from Leadville, the state is capable of making a large aggregate production, of zinc especially, but there is no single district which can be compared with Leadville either in present or prospective output. Of the other districts, the Smuggler at Aspen, the Amethyst vein at Creede, and the Tomboy and Sunnyside in the San Juan district, are all prominent producers of lead or zinc, usually both together. In the minor districts, the Wellington at Breckenridge and Iron Mask at Red Cliff produced largely this year, and the Mary Murphy at St. Elmo will contribute to the production of 1913. The ores of the latter mine, however, carry appreciable quantities of gold and silver, especially in the upper levels. A deep drainage adit was recently completed at the Rawley mine at Bonanza. This mine is said to be in a condition to produce a large tonnage of lead ore, when equipped with milling facilities. Where cut by the tunnel, however, the vein carries mostly copper, with a substantial percentage of silver.

Some of these mines use the roasting and magnetic treatment for the separation of pyrite from blende. This is the case with the Wellington and Iron Mask. The Sunnyside and Mary Murphy, on the other hand, employ the electrostatic method of separation; and a custom electrostatic plant recently commenced work at Ouray. Which method is the more advantageous seems to depend on small physical differences in the ore, on the degree to which the blende is of the rosin or nonferriferous variety, and on the proportion of chalcopyrite, which is rendered less magnetic than pyrite by roasting, and is therefore less perfectly separated magnetically from the blende. The costs of the two methods are probably about the same, the expense of the roast for the magnetic process being offset by the high royalties charged by the owners of the electrostatic patents. In some cases, as for instance, the Tomboy, and Smuggler-Union at Telluride, no ultimate separation is attempted, dependence being placed entirely on wet-dressing methods. Experiments were made with various modifications of the flotation processes, but as yet none of them has been adopted in practice.

In view of the widely spread zinc resources of the state, and the usual small extent of the individual mine, it is probable that central separating plants will ultimately be established by the zinc-smelting interests, purchasing middling concentrates from wet-dressing concentration mills of the usual type. In this way a comparatively inexpensive dressing plant at the mine will suffice, and freight charges are in any case the same before and after separation. Some progress was made in this direction by the Western Chemical Co. in Denver.

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Lead and Zinc in Oklahoma

By L. C. Snider*

The productive lead and zinc field of Oklahoma is in the extreme northeast corner of the state. It is a part of the Joplin, Mo., district, the nature of the ores and the mining conditions being the same. There are three mining camps in the field, Peoria, Quapaw and Miami. The last is by far the most important. In 1911 a deeper run of ore was discovered at Miami, which is much richer than the upper run. The exceedingly strong head of water, however, prevented a large production being made. The low price of zinc concentrates also limited the output during the first half of that year.

In 1912, prospecting greatly increased the area underlain by the orebodies and extended it almost to the Kansas line. Prices were better than during 1911; the developed leases were worked intensively. A 12-in. steam pump of a capacity of 3000 gal. per min. was installed at the 270-ft. level, which lowered the water level sufficiently to permit working the lower runs. Several new concentrating plants were built or are in course of erection.

The Peoria and Quapaw camps made no marked development in 1912, but will probably show an increased production due to the higher prices for concentrates.

*Oklahoma Geological Survey, Norman, Okla.

Considerable excitement has been created from time to time by the zinc field near Davis in the Arbuckle mountains, where small productions have been made during the last few years. This field showed little activity in 1912, and there is little prospect of its becoming an important factor in the zinc output in the near future.

The value of the production of lead and zinc concentrates since 1898 is as follows: 1908, $596,383; 1909, $802,032; 1910, $641,278, and 1911, $513,516. The output for 1912 was greater than that of any previous year, with an approximate value of $1,000,000.

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Tungsten

According to the U. S. Geological Survey, the quantity of tungsten ore mined and marketed in the United States in 1912 was equivalent to about 1290 tons, averaging 60% of tungsten trioxide, besides which a smaller quantity was mined but not marketed. The average price per unit was about $6.35 in 1912, $8 per unit being quoted at the end of the year.

The largest production came from Boulder County, Colo., where the Primos Mining & Milling Co. and the Wolf Tongue Mining Co. were the largest producers. The ore of this district is ferberite. In California, the Atolia Mining Co., which controls the Atolia field, at the north edge of San Bernardino County, increased its production of scheelite and was the largest individual producer of tungsten ore in the United States. The Boulder district will be treated separately in a subsequent issue.

The U. S. Geological Survey reports that in Arizona a few tons of hübnerite concentrates were shipped from the dry placers and some ore from the veins near Dragon; hübnerite ore was shipped from Arivaca to Denver, for concentration; and some scheelite concentrates were shipped from Oracle, where scheelite is associated with gold and silver ores. Small shipments of hübnerite were made from Osceola and Round Mountain, Nev., and Patterson Creek, Idaho. A small quantity of hübnerite was concentrated at Loon Lake, Wash., but none was shipped. One small shipment of wolframite was made from Lordsburg, N. M.

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Bismuth in 1912

The bismuth business of the world in 1912 remained substantially in the hands of the European convention, which for many years has monopolized production, has bullied ore producers and consumers of the metal and, in brief, has acted about as it pleased in its relations with both. The convention's price during 1912 remained at 7s. 6d., London, which was the same as in 1911.

The larger part of the supply of crude metal is derived from Bolivia, where the Aramayo Francke Mines, Ltd., is one of the large producers, making crude metal, which goes to Europe for refining. This company turns out about 170,000 kg. of crude bismuth per annum. In the year ending May 21, 1912, its output fell off about 33,750 kg., but during the five months of 1912, from June to October, inclusive, there was an increase of 37,100 kg.

Only in the United States is there any independent production of bismuth worth mentioning. Here, the U. S. Smelting, Refining & Mining Co. produces a relatively small quantity out of its Betts process slimes. This company is too big for the European convention either to buy out or to frighten, its bismuth production being merely an incident anyway. Also, it is able adequately to guarantee protection to its customers. Apparently the directors of the European convention shut their eyes to the American production, whether it likes it or not, and the American producer keeps its output within such limits as enable it to market all at a little under the convention's price without inciting a trade war, which probably neither party wants. The quotation for bismuth in the United States in 1912 was $1.72 per lb. throughout the year.

The American production of bismuth in 1912 was about the same as in 1911. In 1913 there will be a new producer, viz., the American Smelting & Refining Co., which is going to make the metal at its Omaha plant; no details of the process can be obtained. Experiments are also said to have been made at Chrome (U. S. Metals Refining Co.), and Perth Amboy (American Smelting & Refining Co.) on bismuth recovery, but no commercial production was made in 1912, so far as we can learn.

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Diamond Mining in Arkansas

By John T. Fuller*

The diamond mining industry in Arkansas is not in as flourishing a condition as could be desired. However, more work contributing to future progress has been done in 1912 than in any previous year since the discovery, six years ago.

The Ozark company did more work in 1912 than any other concern. This company owns one corner comprising five or six acres in the northeastern section of the large "pipe" first discovered. During the latter part of the year the Ozark company purchased and erected a steam washing, crushing and recovery plant capable of handling about one hundred 16-cu.ft. loads per day. This is the first plant of any size to be erected on the field, and it is due entirely to the courage of the Bemis Bros. of Prescott, Ark., that this step in advance has been made. It is expected that this equipment will be in full operation before the beginning of 1913, and the results obtained will largely determine whether or not the Arkansas diamond field will ever become a factor in the diamond market of the world.

On the Mauney tract, which borders the Ozark property, active operations are also in preparation. A washing plant is in the course of erection on the banks of Prarie Creek by A. Q. Millar and associates who have obtained a lease on the property from Mr. Mauney.

No work of any importance was performed on the land of the Kimberlite company nor on that of the American Diamond Mining Co., which lies a few miles to the north of the large pipe. The Arkansas Diamond Co. which owns the largest portion of the pipe, on which are situated the Ozark and Mauney properties, did little actual work in 1912. The small washing plant was operated at irregular intervals but always with results in the way of diamonds recovered. A large number of additional test pits were sunk and one diamond drill hole put down for the purpose of observing the weathering qualities of the peridotite at depth. The year 1913 should go a long way toward proving the value of the field.

*Consulting engineer, Honesdale, Penn.

The Tin Industry in 1912

Imports of tin into the United States for 10 months ended Oct. 31, the latest official figures, were 44,405 long tons, an increase of 3338 tons, over 1911. Reëxports of foreign tin were 520 tons in 1912, making the net imports 43,885 tons.

Imports of tin into Great Britain for the 11 months ended Nov. 30 were 35,191 tons, a decrease of 2849 tons. Imports of tin ore and concentrates, mainly from Bolivia, were 24,540 tons. Exports in 1912, including reëxports, were 36,904 tons, or 1713 tons more than the imports of metallic tin.

Figures for the tin production of the world are necessarily based upon the market reports of shipments and receipts. The chief part of the production is recorded in what are generally known in the trade as "The Statistics," which cover from 70 to 75% of the total, and which are closely kept, both as to shipments and deliveries. These figures are given in Table I herewith, covering the 12 months ended Nov. 30, 1912.

I. SUPPLIES AND DELIVERIES OF TIN INCLUDED IN STATISTICS

(In long tons)

Supplies:	1911	1912	Changes	
Straits exports	53,470	59,962	I.	6,492
Australian exports	4,048	3,898	D.	150
Banka sales	14,908	15,857	I.	949
Billiton sales	2,208	2,208		.....
Total supplies	74,634	81,925	I.	7,291
Deliveries:				
Great Britain	15,202	16,748	I.	1,546
European Continent	22,525	24,972	I.	2,447
United States	39,150	43,440	I.	4,290
Total deliveries	76,877	85,160	I.	8,283

II. SUPPLIES OF TIN ENTERING INTO CONSUMPTION BUT NOT INCLUDED IN STATISTICS

(Long Tons)

	1911	1912	Changes	
Chinese exports	2,411	3,730	I.	1,319
Bolivian exports	22,177	20,766	D.	1,411
Cornwall production	4,500	4,450	D.	50
Transvaal production	2,256	2,350	I.	94
Miscellaneous	850	975	I.	125
Total	32,194	32,271	I.	77

The visible stocks of tin on Dec. 31, 1912, are reported as in the accompanying table, in long tons of 2240 lb.:

	Stone	Afloat	Total
Great Britain	2,285	4,526	6,811
Holland	712	183	895
U. S., excluding Pacific ports	1,290	1,981	3,271
Total	4,287	6,690	10,977
Total, 1911	9,195	7,319	16,514

The decrease during the year in visible stocks was 5537 tons.

There is a considerable production of tin which is not included in the statistics, and the estimated quantity of this is given in Table II. This tin is usually accepted as entering immediately into consumption.

The total production, as covered by the two tables, was 106,828 long tons in 1911 and 114,196 in 1912; an increase of 7368 tons, or 7%, the increase in deliveries being 7.7% for the year.

The London Tin Market

January saw an active tin market, but with fluctuations many and wide. Straits tin was scarce, the supply commanding up to £205 per ton for prompt delivery; standard tin for similar delivery being quoted £192, and for three months' delivery £184 10s. The lowest prices for standard were recorded on Jan. 12, £184 for cash, and £182 for three months. At the periodical Banka auction 2614 tons were sold for £194 15s. Closing prices for standard were £194 15s. cash, and £192 2s. 6d. three months.

About the middle of February, £198 10s. was paid for several spot parcels. Trade demand was large and constant. Closing prices were £193 for cash standard and £189 10s. for three months.

The strike of British coal miners in March greatly restricted consumption of the metal in the United Kingdom. Speculative enterprise was attracted to other markets, and price of standard drifted down to £189 10s. cash, and £2 to £5 5s. less for extended delivery. At the Banka auction in Amsterdam 2640 tons were sold at the relatively high equivalent of £201 5s. Toward the close, standard was quoted £195 prompt; £191 three months.

MONTHLY AVERAGE PRICES OF TIN IN 1911 AND 1912

	New York		London	
Month	1911	1912	1911	1912
January	41.255	42.529	186.896	191.510
February	41.614	42.962	189.642	195.036
March	40.157	42.577	182.617	192.619
April	42.185	43.923	193.042	200.513
May	43.115	46.053	197.767	208.830
June	44.605	45.815	207.388	205.863
July	42.406	44.519	193.100	202.446
August	43.319	45.857	190.479	208.351
September	39.755	49.135	180.846	223.762
October	41.185	50.077	187.138	228.353
November	43.125	49.891	194.967	227.619
December	44.655	49.815	203.358	226.875
Av. year	42.281	46.096	192.353	209.322

New York in cents per pound; London in pounds sterling per long ton.

In April prices advanced persistently, only checked occasionally by bear raids until, on Apr. 29, cash standard touched £215, and three months £212; closing prices being £210 and £208.

Toward the end of May trans-shipments were impeded by a strike of dock laborers in London, supplies had to be drawn from public warehouses, and dealers were in difficulties as to fulfillment of their contracts. The result was a sensational advance to £215 10s. for early delivery, the three months' price being, however, no better than £203 10s. Thereafter followed a rapid decline, partly induced by the sale of Banka in Amsterdam, whereat the average price was equivalent to £199 10s. Heavy shipments from the Straits contributed to the depression, and closing prices were the lowest of the month, £200 for prompt delivery and £195 for three months.

In June the cash price varied between £200 and £208. Closing prices were £209 cash and £203 15s. for three months.

In July values drifted down to £195 10s. cash, and £194 for three months. At the Amsterdam auction, 2640 tons Banka were sold to keen bidders at the average equivalent of £210 7s. 6d. Closing prices in London were £205 5s. cash, and £203 for three months.

In August prices declined to £202 5s. cash, and £199 10s., respectively. Closing prices were £218 5s. cash, and £217 5s. for three months.

In September there was a relapse of about £2 per ton. Demand then revived and the upward rush was intensified by a revival of American demand long overdue. When the cash price touched £227 15s., an organized bear attack achieved a temporary relapse of £6 per ton, but failed to dislodge any important quantities. The upward movement recommenced and was unchecked until—on Sept. 26—£233 was paid for prompt delivery, and £231 10s.

for three months. In Amsterdam, 2640 tons of Banka were sold at the relatively low equivalent of £224 12s. 6d. Closing prices were £230 15s. cash, and £229 5s. for three months.

In October an initial relapse of £4 per ton was soon recovered under the persistent trade demand, particularly from America, and the market was comparatively uneventful down to Oct. 14, when—in sympathy with a general panic on the Stock Exchange—the three months' price fell to £220. Purchasing induced a recovery to £232 for cash, and £230 15s. for three months. The market closed at £229 5s. for cash, and the same price for three months.

In November, favorable statistics induced an opening advance to £230 5s. for prompt delivery, and £229 15s. for three months, which proved to be the highest of the month. At the higher prices Eastern holders showed more willingness to sell, and American consumers less readiness to buy; and business was impeded by the continued hostilities in Southern Europe. The Dutch sale of Banka disposed of 2685 tons at the average equivalent of £226 15s. Closing prices were £225 15s. for cash and £225 12s. 6d. for three months.

December opened with a lower tendency, but a good demand developed and toward the middle of the month prices advanced. During all this month the backwardation disappeared and the prices for futures were equal to or slightly higher than spot. This continued till the close, when a backwardation again developed. The close was at the highest of the month, £229 10s. for spot and £229 for three months.

The New York Tin Market

The excellent position in which tin finds itself, statistically speaking, became more pronounced during 1912. The production which, during the past few years, has but slightly increased, has hardly kept pace with the growing consumption of the metal in all quarters of the world. The increase in consumption has mainly taken place in the United States, where the tin-plate industry, especially, was very prosperous during 1912. These favorable conditions have made it easy for the European syndicate, which controls the tin market of the world, to manipulate it in the upward direction. The new contract for Standard tin was introduced on the London Metal Exchange at the beginning of February, 1912. Under its rules, other brands of tin than the Straits, Malacca or Australian brands, which previously formed the only good delivery against the Metal Exchange contracts, can be delivered, thus avoiding the violent fluctuations of former days brought about by a squeeze of the shorts.

The year started in with a very weak market, due to the financial embarrassment of one of the London metal houses interested in tin. Prices quoted were about 42c. for January tin, while spot tin was exceedingly scarce and commanded a premium of up to 1½c. per lb. At this level a good deal of tin was purchased by American consumers, with the result that the London market became firmer and stayed around 43c. per lb. until the beginning of March. The dock strike which broke out at the beginning of March tended to unsettle the tin market, owing to the fear of smaller deliveries, which would affect statistics unfavorably. This influenced domestic buyers, who previously had taken good sized quantities, but who then became reluctant in continuing their purchases. The market declined to about 42c. until the latter part of March. Then it became strong again on heavy American buying, and the price moved back to 43c., where it remained until about the middle of April. About this time it became apparent that consumption of tin was so heavy as to run ahead of production. In consequence, visible supplies decreased continuously. The market became exceedingly strong and advanced very rapidly to over 46c. per lb., on which level it remained until about the middle of May. Heavy shipments from the East which were then cabled, affected the market unfavorably and it declined to about 45c. About the middle of June it was found that the large shipments from the Straits could not be handled readily on account of the London dock strike, and that stocks in warehouse had dwindled to almost nothing. Prompt material became exceedingly scarce, and a premium of as much as £10 was paid over future material. The New York market was similarly affected, and spot tin was selling at about 3c. over shipment tin, which latter was quoted at about 45½c. The larger arrivals of tin, shipped direct to this port from the East Indies, alleviated the scarcity, and prompt material became more plentiful.

In July the market became weak in sympathy with the decline in London, and remained at 43½@43¾c. per lb. until the end of that month. At that time it became known that the Banka tin available during 1913 would be about 1800 tons less than that sold during 1912. This fact, coupled with the very much better demand from the United States, had a hardening effect on the London market. Prices advanced to about 45½c. During August the market fluctuated slightly, but in the main retained its strong tone. When the excellent statistics for August became known at the beginning of September, the market developed a great deal of strength, and advanced rapidly to about 50c. about the middle of September. A reaction of about £5 in the London market affected the domestic market to a like extent, and prices declined to 48¾c. per lb. for September delivery. This decline was, however, rapidly recovered, and the end of the month saw prices again at over 50c. per lb. The American buyers were rather chary in contracting ahead for their requirements on this basis, and only covered their absolute needs.

About the middle of October, when the troubles began among the Balkan States and Turkey, the tin market in London was adversely affected for a few days, scoring a maximum decline of about £7. However, it not only quickly recovered from this decline, but made further advances, so that quotations were established in this market at about 50¼c. per lb. about the middle of October. It remained on the basis of 50c. per lb., with slight variations, until the end of November. The war in Southeastern Europe is said to have interfered greatly with a large part of the European consumption of tin, and while the American business continues to be satisfactory, orders from European consumers have, for the above reason, fallen off considerably. The market was but slightly affected by these considerations, and stood at about 49½c. per lb. at the beginning of December. American consumption continued at a high rate, and purchases were therefore made on a liberal scale. This sustained the market, giving it a firm undertone, with prices ruling at between 50c. and 50⅜c. per lb., in New York, up to the end of the year.

Quicksilver Mining in 1912

The production of quicksilver in the United States in 1912 showed a large increase, the output of California having been 20,613 flasks, and of other states, chiefly Texas, 4534 flasks, a total of 25,147 flasks. There was no production of quicksilver in Arizona, Oregon, Utah or Washington, either in 1912 or 1911, so far as has been reported. In Nevada there was a largely increased output in 1912 from the Mercury mine, in Nye County, where a modern Scott furnace was put in operation. A small production was also reported from the Telluride mine, near Beatty, Nev. Some quicksilver developments were made on Bare Mountain and in other places near Beatty.

AVERAGE MONTHLY PRICE OF QUICKSILVER
(Per Flask of 75 Lbs.)

1912.

Month	New York	San Francisco		London
		Domestic Sales	For Export	
January	$43.00	$42.50	$40.00	£8.06
February	45.50	44.63	41.13	8.35
March	44.60	44.10	41.60	8.53
April	42.06	41.75	39.75	8.54
May	41.56	41.50	39.00	8.25
June	41.40	41.30	38.80	8.30
July	42.50	42.00	39.50	8.50
August	42.38	41.88	39.38	8.06
September	42.00	41.50	39.00	8.05
October	42.03	41.50	39.00	8.00
November	42.03	41.50	39.00	7.63
December	40.50	40.40	37.90	7.42
Year 1912	$42.46	$42.05	$39.55	£8.14
Year 1911	46.54	46.01	43.62	.....
Year 1910	47.06	46.51	44.54	.....

We have not yet received much information respecting the production of quicksilver in foreign countries in 1912. Promising deposits of quicksilver ore are said to have been discovered in the Urals, in the Verch Isset district, near Lake Ayatsky, 20 miles from Neviansk, on the Perm railway.

Quicksilver in California

By Lewis H. Eddy

The production of quicksilver in California in 1912 amounted to approximately 20,500 flasks of 75 lb., an increase over 1911 of about 4000 flasks. There was a decline in the production of the large mines in San Benito County, but an increase in the large mines in Santa Clara County. The small producing mines showed an aggregate increase. The normal production, based on the capacities of the mines, should have been equal to an increase over 1911 of 1000 to 1500 flasks. San Benito County produced approximately 9300 and Santa Clara County about 7200 flasks. New discoveries and extensive development are accountable for the increase over 1911. New development work was done at both large and small mines, and cinnabar discoveries of encouraging quantity and value were reported. The New Idria gave more attention to development than to increased production, owing to low prices and to absence of special demand for income from sales. Market conditions suggested development rather than increased production, and ore reserves were considered of more value than increased sales at low prices.

In Santa Clara County both the Guadalupe and the Almaden opened new orebodies and made improvements in the mines, and had prices been better the increase in production would no doubt have been larger. The Guadalupe made great advances in 1911 and still greater in 1912, and the Almaden is reported to have improved largely in 1912. The prospect, known as El Dinero, near the Guadalupe, made gradual improvement during the year. More attention was given to the exploration of the ground than to development of the known deposits. Preparations were made for economical and profitable development when prospecting shall warrant it.

The small mines in the south and north are reported to have produced a total of 1200 to 1500 flasks in the year, although not all of them were operated regularly. This was an increase over the production of 1911, and resulted from increased activity of the owners, who desired present small profits rather than future possibility of larger profits. Some sales were reported to have been made to large producers instead of direct to the market. In the northern part of the state, production increased at most of the operating mines, except the Great Western, and there was a small aggregate production from the irregular working of others. In the southern end of the quicksilver belt the production was chiefly from San Luis Obispo and San Benito Counties. The small mines in San Benito, southwest of Idria, produced several hundred flasks in 1912, and were preparing at the close of the year to increase furnace capacities, apparently warranted by the results of development. One of these mines, the Hernandez, formerly known as the Ramires, was taken over by a new company. Some prospecting and partial development occurred at other properties in the counties south of San Francisco, but no commercial production was reported. There are numerous deposits of cinnabar in several counties that have not been thoroughly prospected. The industry could be greatly improved by judicious prospecting and the development of promising small properties. Few of the owners of idle cinnabar claims are practical quicksilver miners, and the organization of stock companies for the prospecting and developing of small mines or new claims was not so easy to accomplish in 1912 as in former years.

Quicksilver Industry of Texas

By William B. Phillips*

No important changes in the condition of the quicksilver industry of Texas occurred in 1912. The Chisos Mining Co. continued to operate its 20-ton Scott furnace on Section 295, Block G. 4, but other properties were idle. Exploration of the deeper lying deposits in the 700-ft. shaft of this company establishes the fact that the ore penetrates the Buda limestone and appears to be of about the same quality as in the overlying formations, Eagle Ford shales, etc. The Chisos Mining Co. has had an interesting history. In the early days of the camp, 1900-1901, this property yielded extremely rich ore from the Eagle Ford shales, the ore occurring almost at the surface.

The ore was treated in D-shaped iron retorts and scarcely any material carrying less then 6% mercury was used. As late as 1905-1906, the ore yielded a black oil, of lubricating quality, a combustible gas and

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quicksilver. Since the introduction of the Scott furnace, however, the oil and gas, while still present, are not recovered. In 1905, operations on this property were virtually abandoned and I was asked to report on the situation. After spending two months in the examination, I advised that work be continued, expressing the opinion that material carrying 2% of mercury could be obtained in sufficient amount to warrant the building or leasing of a furnace. I remained on the property until the autumn of 1906 and had the satisfaction of knowing that my estimates of tonnage and value were abundantly sustained. Material carrying more than 2% of mercury was treated in a leased Scott furnace and new supplies of ore of this grade were added to the reserves. Owing to circumstances of a business character, in no wise related to the extent or quality of the ore, it has been found best to send stuff of somewhat lower grade to the furnace that has been built on the property, i.e., to handle a larger tonnage of lower grade ore instead of a smaller tonnage of better ore. The camp has been greatly enlarged, excellent stone, brick and cement houses have been erected, an ice-making plant installed, and a commodious and well stocked commissary added.

What has been done with this property can be done with others similarly situated in the Terlingua district.

The total production of quicksilver in the Terlingua district, Brewster County, including the output of 1912, is in excess of 47,000 flasks, valued at more than $2,000,000. By far the greater proportion of this has come from the hard, dense limestones of the Edwards formation, which have yielded ores of extraordinary richness at comparatively shallow depths, down to 100 ft. These ores, however, are harder to mine, the operating and maintenance costs are higher, and much systematic prospecting is required.

It is my opinion that the future of the quicksilver industry in Texas is much more closely connected with the bituminous shales lying between Vogel's Draw and Rough Run, than with the limestones west of Vogel's Draw. In these shales the orebodies are more continuous, the mining costs are less, and the overhead charges are materially reduced.

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Molybdenum Ore

There is annually a small production of molybdenum ore in the United States, but the tonnage has never yet become large. The Primos Chemical Company, of Primos, Penn., is the principal metallurgical concern in this industry in the United States. This company makes chiefly molybdenum metal and ferro-molybdenum. The value in 1912 of the metal was about $1.40 per lb. and of the alloy about $1.60 per lb. of its molybdenum content.

The metallurgical requirement for molybdenite ore is a content of at least 92% of molybdenum sulphide, at which grade the ore is worth approximately $400 per 2000 lb. Copper is the most objectionable impurity. There is no fixed rule as to the maximum amount of copper permissible, but 2 or 3% seriously invalidates the ore, and the less copper there is the better.

Low-grade molybdenite ore, which must be concentrated, is relatively of much lower value, ore carrying 25% molybdenum sulphide being worth only about $25 per ton, or $1 per unit. However, wulfenite, containing at least 25% molybdic trioxide, is worth about $100 per ton.

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Platinum in 1912

While there are, as yet, no figures for the production of platinum in the United States in 1912, there is nothing to indicate that it exceeded the average of several years past. This was about 350 oz., chiefly parted from placer gold obtained in northern California and western Oregon. There is no report of any metal from Wyoming.

Imports of platinum into the United States for the 10 months ended Oct. 31, the latest official figures were: Crude or unmanufactured, 32,539 oz.; refined or manufactured, 51,817 oz.; total, 84,456 oz., a decrease of 19,988 oz. from the corresponding period in 1911. These imports were valued at $3,634,738, an average of $43.15 per oz. in 1912, against an average of $38.63 per oz. in the previous year. No platinum was reëxported.

Russia continues to be the chief source of the supply of platinum. During 1912 there was a good supply of labor in the placers of the Ural region. The large companies were fully supplied with miners, and the starateli, or independent workers and prospectors were in good number and generally active. This was due to the high prices generally prevailing. Moreover work continued unusually late in the fall. It resulted in the discovery of several new deposits, the most important of which was in the Irbit district, which is south of the known deposits of the Urals. This is considered to be an extension of the productive region, and has encouraged prospecting in that region. The Russian production for 1912 is estimated at 310,000 oz., a fair increase over the preceding year.

AVERAGE PRICES OF PLATINUM

In Dollars per Ounce Troy

	New York Refined Platinum	Russia, Crude Metal—83 Per Cent. Platinum	
		St. Petersburg	Ekaterinburg
January	$46.00	$37.73	$37.50
February	45.63	37.83	37.60
March	45.50	37.63	37.47
April	45.50	37.29	37.10
May	45.50	37.00	37.04
June	45.50	36.80	36.85
July	45.50	36.75	36.85
August	45.50	36.75	36.85
September	45.50	36.65	36.85
October	45.50	36.65	36.85
November	45.50	36.80	36.85
December	45.50	36.95	36.85
Year	$45.55	$37.08	$37.05
Average for 1911	43.12	35.21	35.09
Average for 1910	32.70	26.96	26.37

In Colombia, the second producer, the attempts being made to systematize working and to introduce dredging in some of the chief placers have made slow progress. The output continues rather irregular, though it is increasing. The total is estimated at about 12,000 oz. for the year.

Small quantities are also obtained in British Columbia and Australia, but the amount is not important. From time to time also small quantities are saved in refining nickel matte from the Sudbury region in Canada.

The demand for platinum is increasing faster than the supply. The newer requirements, in the electrical and automobile-engine industries, absorb the metal and remove it from the market entirely. The same is largely the case in the jewelry manufacture. The metal used in making chemical ware is largely returned in the form of scrap for remanufacture.

Iron and Steel in 1912

By Frederick Hobart

The year 1912 will be memorable in the iron and steel industries for the rapid recovery from depression and a notable increase in production which carried the total outputs of nearly all forms to a higher level than had ever before been recorded. It will be remembered that in the first half of 1911 there was a period of marked depression and reaction from the overproduction of the preceeding year, followed by a second half year of a very slow and halting recovery. About the beginning of 1912, however, it became apparent that the population and industrial demands of the country were reaching points which had never before been attained. In other words the natural growth of the country had caught up to and was beginning to pass the expansion in productive capacity of the iron and steel works which occurred during and immediately after the boom of 1906-7.

The year opened rather quietly, but the period of expansion soon set in and continued gradually and with little halt, until in the second half, a production was demanded which exceeded that of any similar previous period in our history. The year closed with demand at its highest point; with furnaces and mills operating close up to their full capacity and furnished with contracts and orders sufficient to carry them well through the first half of 1913, it is hardly necessary to say that accumulated stocks of material were almost completely used up.

Iron Ore

The production and consumption of iron ore for three years past are estimated as in the accompanying table I. The slight increase in stocks reported for the year was mainly in that of Lake ore carried on the receiving docks and the increase was due not to any lack of demand, but to scarcity of cars and of railroad facilities for shipment. There are no sufficient statistics from which to estimate the stocks in furnace yards, but the general testimony is to the affect that they certainly do not exceed those of a year ago; in fact many furnaces have their yards almost bare and are dependent on daily shipments.

Lake Superior ores continue to furnish by far the greater part of our raw material. We cannot vary greatly from the estimate which was held good for several years that over 80% of our pig iron is made from Lake Superior ores, which supply not only the furnaces of the Central West, but even to some extent find their way east of the Alleghenies.

The statistics of the Lake Superior ore shipments are carefully kept and generally accessible. Full particulars of the movement of that ore for three years past are given in tables II, IV and VI.

The iron mines of the South are for the most part closely controlled by the manufacturing companies and the production is generally proportioned rather closely to the activity of the furnaces, as it is not the usual custom to carry any large stocks. Many improvements have been made at the Southern mines, especially in Alabama, in the way of mining and preparation of ores. Some new mines have been opened and toward the close of the year, arrangements were made to test several of the large brown-ore mines in the Birmingham district by boring and sinking shafts in order to determine whether the deposits extend to depths below the present workings.

In the Eastern states the demand for iron ore led to increased activity in the old mines of New York, New Jersey and Pennsylvania and several new mines were opened and some old mines reopened, while some advances were made in the way of treating the ore by concentration and otherwise to make it more available for furnaces. The principal activity was in the Lake Champlain district of New York, where the chief operators are Witherbees, Sherman & Co., who have, for a number of years, controlled the iron mines in the neighborhood of Port Henry and Mineville. The Bethlehem Steel Co. is also operating the Cheever mine near Port Henry. The Adirondack district in New York has been furnishing an increased quantity of ores at Dannemora and elsewhere, while operations have also been going on in the Clinton ore deposits of Wayne County. In the Hudson River district the Forest of Dean mine, near Fort Montgomery, has been operated steadily and is planning new equipment and development. Arrangements have been made to reopen the old Croton mines near Dover Plains, where a considerable orebody has been proved by drilling, and a magnetic treatment plant is being installed. No new mines have been opened in New Jersey, but a number of older mines have been actively operated.

The imports and exports given in the table are estimated for November and December. The official returns for the 10 months ending Oct. 31 give a total of 1,741,607 tons imported, of which 1,147,783 tons came from Cuba, 209,072 from Sweden, 112,485 from Newfoundland, 90,706 from Canada, 79,111 from Spain and 12,450 tons from other countries, chiefly from Venezuela, where a commencement has been made by an American-Canadian company in working the Imataca ore deposits on the Orinoco River.

An iron-ore development from which large shipments are expected was opened during the year in eastern Texas. Shipments from this deposit will be made chiefly to Baltimore and Philadelphia for use in Eastern furnaces. At the opening of 1912 a larger business was anticipated in imported ores, but a serious check was given to the business by the rapid advance in ocean freights, which in the latter part of the year reached a level which made the cost of Spanish and Swedish ores almost prohibitive, so that probably only a small portion of our ore supply will come from those countries in 1913. The Cuban iron mines are principally owned by American steel companies, which control their own carrying vessels and use the ore in their own works, very little Cuban ore being sold in the open market. There are also likely to be some imports in 1913 from the Wabana mines in Newfoundland, although the scarcity and high cost of ocean tonnage will affect that business also.

The exports of iron ore as officially reported for the ten months were 1,088,901 tons and were mainly of Lake Superior ore to Canadian furnaces.

As is well known, the prices of Lake Superior iron ore are usually fixed for the season early in the year, and those prices for the season of 1912 were as follows: Old Range bessemer, $3.75 per ton; Mesabi bessemer, $3.50; Old Range nonbessemer, $3; Mesabi nonbessemer, $2.85. These prices are all f.o.b. docks at Lake Erie ports, the

basis being 55% iron and under 0.45 phosphorous for bessemer ores; 51.5 iron for nonbessemers. The cost of these ores for furnaces is increased by the freight from the Lake port to the furnace, varying, of course, according to its location. During the year the Interstate Commerce Commission ordered a reduction from 80c. to 60c. in the rate charged for carrying ore from the mines to Lake Superior ports.

I. IRON ORE PRODUCTION AND CONSUMPTION

	1910	1911	1912
Lake Superior	42,442,397	32,743,190	48,410,477
Southern states	7,500,000	6,425,000	7,590,000
Other states	3,325,000	2,660,000	3,485,000
Production	53,267,397	41,878,190	59,485,477
Decrease in stocks	.....	650,000	.....
Imports	2,591,031	1,811,732	2,200,000
Total supplies	55,858,428	44,339,922	61,685,477
Deduct exports	644,875	768,386	1,307,000
Increase in stocks	950,000	.....	200,000
Approximate consumption	53,263,553	43,571,536	60,178,477

Toward the close of the year it became apparent that there would be an increase in rates for 1913 and these were fixed at an unusually early date, November instead of January or February, as has been common. The new rates were as follows, on the same basis of contracts as for 1912: Old Range bessemer, $4.40; Mesabi bessemer, $4.15; Old Range nonbessemer, $3.60; Mesabi nonbessemer, $3.40 per ton. This increase is equivalent to an advance of about $1 per ton in the cost of pig iron.

II. SHIPMENTS OF LAKE SUPERIOR ORE

	1910	1911	1912
By lake	42,620,206	32,130,471	47,435,477
By rail	822,391	662,719	975,000
Total	43,442,597	32,793,190	48,410,477

Rates on Eastern iron ores also advanced during the year. It is impossible to give detailed rates, but in a general way it may be said that it was approximately from about 6¾ to 7¾c. per unit of iron at mines, while for foreign ores the advance has been from 7 to 8¼c. per unit of iron at landing port.

III. DELIVERIES AT LOWER PORTS

	1910	1911	1912
Lake Erie ports	33,498,455	25,531,550	38,624,108
Lake Michigan Ports	.....	7,452,084	8,357,070

Pig Iron

The production of pig iron, which in 1911 was at the rate of about 1,950,000 tons, and did not vary very greatly through that year, commenced to expand early in 1912 and for the first half of the year reached a total of 14,072,274 tons according to the report of the American Iron & Steel Association. During the second half of the year production continued to increase and our estimate, based on the reports of the activity of the furnaces, gives a total for that half of 15,575,000 tons, making a total for the year of 29,647,274 tons of pig iron in 1912. It is probable that the total would have gone over 30,000,000 tons for the year had not a scarcity of coke developed in the last three months, which prevented some furnaces from blowing in, and limited the activity of others also in blast. Table I shows the total pig-iron production for four years past.

IV. SHIPMENTS TO FURNACES THROUGH LAKE ERIE PORTS

	1910	1911	1912
Stocks on docks, May 1	5,444,080	6,778,494	5,881,245
Receipts for the season	33,498,455	25,531,550	38,624,108
Total	38,942,535	32,310,044	44,505,353
Shipments to furnaces	29,515,654	23,178,380	35,010,728
Dock stocks, Dec. 1	9,426,881	9,131,664	9,494,625

Assuming that the production of iron in the second half of the year was divided in about the same proportion as that for the first half, we have prepared table II, which shows the production classified according to the uses for which it was intended. It is possible that the final figures may show some differences in this, especially in the proportions of basic and foundry irons. Table III shows the total pig-iron production for 10 years past, the facts therein presented requiring no special comment.

I. PIG IRON PRODUCTION

	1909	1910	1911	1912
First half	11,022,346	14,978,738	11,665,796	14,072,274
Second half	14,773,125	12,319,807	11,983,548	15,575,000
Total	25,795,471	27,298,545	23,649,344	29,647,274

Two years ago we reported a large increase in the stocks of pig iron unsold or unused at furnaces. In 1911 a substantial decrease in these stocks was secured, and in 1912 they were substantially absorbed. At the close of the year there was, undoubtedly, no stocks of unused or unsold iron at furnaces beyond those which it is always necessary to carry as a balance and to prevent an absolute reliance upon daily production. Table IV shows the approximate consumption of pig iron for three years past, in which allowance is made for these changes in stocks. The imports and exports of pig iron are estimated for November and December.

II. PIG IRON PRODUCTION CLASSIFIED

	1910	1911	1912
Foundry and forge	6,350,605	5,256,815	5,965,591
Bessemer	11,244,612	9,409,107	11,740,055
Basic	9,084,520	8,520,029	11,386,176
Charcoal	394,377	278,676	353,266
Spiegel and ferro	224,431	184,717	202,186
Total	27,298,545	23,649,344	29,647,274

III. PIG IRON PRODUCTION FOR 10 YEARS

1903	18,009,259	1908	15,936,018
1904	16,497,003	1909	25,711,846
1905	22,992,380	1910	27,295,592
1906	25,307,391	1911	23,649,344
1907	25,781,381	1912	29,647,274

The consumption for 1912 was approximately 703 lb. per capita, being 109 lb. more than in the preceding year.

In this computation, however, no account is made of the products of pig iron exported in the form of finished iron and steel.

IV. CONSUMPTION OF PIG IRON

	1910	1911	1912
Production	27,298,545	23,649,344	29,647,274
Imports	237,233	148,459	125,000
Decrease in stocks	.....	1,250,000	600,000
Total supplies	27,535,778	25,047,803	30,372,274
Exports	127,385	120,790	268,000
Increase in stock	1,700,000	.....	.....
Total deduction	1,827,385	120,790	268,000
Consumption	25,708,393	24,927,013	30,104,274

Exports and Imports

The latest official returns from the Bureau of Statistics cover the 10 months ended Oct. 31. For that period the foreign trade of the United States in iron and steel is valued as follows for three years.

	1910	1911	1912
Exports	$158,478,345	$199,209,431	$238,972,631
Imports	32,937,752	24,663,544	23,885,776
Excess, exports	$125,540,593	$164,545,887	$215,086,855

The quantities of the leading articles of export and import for the 10 months in the past two years were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron	101,711	223,387	126,318	102,945
Scrap	69,523	88,675	16,476	17,232
Billets, blooms, etc.	202,961	254,415	24,103	15,435
Bars	118,367	195,984	23,180	21,227
Rails	372,860	379,247	.....	.....
Sheets and plates	289,751	457,655	1,936	2,853
Structural steel	177,591	241,599	.....	.....
Wire-rods	16,205	52,847	13,106	12,632
Wire	181,520	208,606	.....	.....
Nails and spikes	60,067	80,643	.....	.....
Tinplates	49,674	72,519	13,443	1,784
Pipe and fittings	163,476	210,859	.....	.....

Steel

For the first time statistics of steel production in the United States were made up for the first half of the year in 1912. The production for that period was 14,373,701 tons, of which 9,414,706 tons were openhearth, 4,868,306 tons bessemer and 63,689 tons crucible and special steels. Of the total reported 8,927,579 tons were basic steel and 5,466,122 tons acid steels. The production for the second half of the year was undoubtedly greater than that for the first half by at least the same proportion as the output of pig iron. On this basis we have estimated the total production of steel for the year at 29,745,000 tons, of which 19,600,000 tons approximately were openhearth, 10,015,000 tons bessemer and 130,000 tons special steels. The proportion of basic steel to the total was about 62.5% and of acid steel 37.5%. The basic openhearth steel process is undoubtedly the growing steel industry in the United States.

The report already referred to gives the production of finished rolled products in the first half of the year at 11,201,819 tons; 10,422,338 tons being of steel and 779,481 tons of iron. Estimating an increased production for the second half year on the same basis, the finished rolled products in 1912 probably exceeded 23,500,000 tons. These figures of course will be subject to some revision by the completed returns. The large increase over 1911 in finished products appears to have been pretty well distributed; the most notable gains being in structural steel in plates, bars and rails. There was also an important gain in tin plates.

United States Steel Corporation

The business of the Steel Corporation increased largely during the year, though it is doubtful whether it quite held its own in the proportion which it furnished of the total steel production of the country, which was probably somewhere about 45%. For the nine months ended Sept. 30, the published reports give the total net earnings over operating expenses, repairs and renewals at $72,992,800, a decrease of $8,157,648 from the corresponding period of 1911. The decreased earnings on a largely increased business were due to the low prices which prevailed during the earlier part of the year. The report of unfilled orders on the books Nov. 30, gives a total of 7,852,883 tons a large increase during the year and the record of reported orders since 1906. For the past three months the mills of the Steel Corporation have been reported as running at 95% of rated capacity, which means practically full, since no plant runs to its full capacity for any considerable length of time under any possible circumstances.

The Alabama Iron Market

By L. W. Friedman*

When it is taken into consideration that upwards of 200,000 tons of accumulated pig iron were worked off, the pig-iron production and disposition in the Southern territory in 1912 was most favorable. With the figures for the last month approximately considered, there was a larger production of pig iron in the Southern territory than the previous year but a falling off as compared to 1907 and 1910. Alabama, the leader among the Southern iron-producing states, made an excellent showing as to production, considering that the year started uncertainly and with the margin of profit small.

Starting at a price near $10 for No. 2 foundry, the year closed with sales being made for delivery during the first half of the coming year at $15 per ton, with a large quantity of the probable make sold above $13.50 per ton and the make increased from around 146,000 to 167,000 tons per month. The Southern states in 1911 produced 3,011,386 tons of iron. The year just over will probably report an increase of 3,150,000 tons. The unsteady condition throughout the Southern iron market for the 24 to 36 months before July was not easy for all the concerns. Two companies in Alabama succumbed to the pressure and went into bankruptcy, but the tenacity of the manufacturers became apparent and as the year 1912 dissolves, the reorganizations of both these concerns are well in hand and within a few weeks both companies will not only be on their feet but will have a large working capital provided and preparations for a larger production of pig iron and other products.

Much construction work was done in the Southern territory in 1912. One iron blast furnace was built outright and two others practically rebuilt, while several had more or less repairs made about them.

The pig-iron production in Alabama for 1912 was upwards of 1,827,273 tons. In 1911 the production in this state went to 1,712,443 tons, in 1910 to 1,939,147, in 1909 to 1,763,617 and in 1907 to 1,686,674 tons.

There was a larger output of basic iron, too, the needs of the steel-making plants being large. The plants of the Tennessee Coal, Iron & Railroad Co. saw for the first time a steady operation during the summer and the better part of the year. The year started in with the steel industries working only a portion of the works and it closes with activity on all sides, and with unfilled contracts in hand, that will require a steady operation for several months to come. The railroads placed many orders for steel rails in the South. The farmers and others bought freely during the last few months of the year of steel wire, both barbed and plain. Fabricated steel was in steady demand throughout 1912, though the Tennessee Company's plant had a limited capacity.

The machine and foundry industry did not fare as profitably as did their kindred interests. Some labor troubles were experienced. However, the business was not altogether the worst ever witnessed. Charcoal iron held its own. There was steady operation at car-wheel works in the South. The scrap-iron market had its ups and downs, starting with unsteady trading and closing with considerable activity and satisfactory prices.

*Birmingham, Alabama.

Pittsburgh Iron and Steel Markets

By B. E. V. Luty*

The year 1912 in the iron and steel trade has been one of almost spectacular improvement, with respect to prices and the accumulation of business at the mills. In October, 1911, the mills had no accumulation, and were able, as a rule, to make shipment on new specifications in from one day to one week. Rolling schedules were being made up almost from turn to turn, and in the case of merchant mills rolls were changed almost daily to fill such specifications as became available.

At the close of 1912 the mills had actual specifications on books for an average run at full capacity for about three months, with contract business in addition apparently insuring their operation at full capacity into the midsummer period. Rolling schedules were made up long in advance, sometimes permitting several weeks of operation on a single description of material. Buyers requiring prompt delivery were buying in carload and larger lots out of jobbers' stocks, where they could be found, and were also buying from the smaller mills, which do not customarily take contracts, paying in each case very substantial advances over regular mill prices for far forward delivery, even though those had been advanced very substantially during the preceding 13 months.

In the closing three months of 1911, pig iron was being made at the rate of 25,000,000 tons annually, which constituted an improvement over the average of the year, the production of 1911 being officially reported at 23,649,547 gross tons. Prices nevertheless were falling, and in November reached very low points, the lowest since 1904 in the case of pig iron and the lowest since the beginning of 1899 in finished steel. A revival began in that month, chiefly by way of heavy car buying. Other buying began in more diffident fashion, but sufficient to make the market of December, 1911, a definitely advancing one. Apparently the advancing movement was somewhat too rapid; at any rate, the market had a slight backset during January and February, 1912, so that a low point was reached in March, though not as low as that of the preceding November. The low point in pig iron, on the average, fell at the beginning of 1912, but in the first two months of the year the market was irregular, some grades of pig iron declining, others advancing.

By the middle of March the last uncertainties were past, and from that time to the close of the year there was a definitely advancing market in pig iron, unfinished steel and finished-steel products.

The advance in pig iron, averaging all important grades in keeping with their commercial importance, was a trifle over $4 a ton from Jan. 1, 1912, to Dec. 31, 1912. About 40c. of this advance occurred in the first quarter, 40c. in the second quarter, $2 in the third quarter and $1.25 in the fourth quarter. Southern iron advanced from $9.75, Birmingham, to $14; bessemer iron, Valley, from $14 to $17.25; basic iron, Valley, from $12.25 to $16.50; No. 2 X foundry, Philadelphia, from $14.75 to $18.25; and No. 2 foundry, f.o.b. Chicago furnaces, from $14 to $18.

The total advance in finished-steel products, averaging all important descriptions outside of standard-section rails, from the low point in November, 1911, to the close of 1912, was about $6.70 per net ton, but from the subsidiary low point early in 1912, about $6.15 per ton. The advances were fairly uniform in plates, structural shapes, bars, merchant pipe, wire products, sheets and tinplates, but the advance in wire products was the smallest, only $5 a ton from the low point in November, $1.50 for nails, to $1.75 at the close of 1912.

These advances, while fairly large, did not bring prices up to an immoderate level. Both in pig iron and in finished steel, the closing prices of the year were somewhat below the top prices on the 1909 rise, and very much below the prices reached in the great movement of 1905-6-7. The advances had started from a lower level than had been reached for years.

The buying which started in November, 1911, was based chiefly upon the fact that prices were extremely low. While the mills became better filled with specifications, they did not fall uncomfortably behind in deliveries, nor were they measurably behind in January, 1912. The continuance of fairly heavy buying caused them to begin to fall behind in the spring of the year, and this fact then induced buyers to buy still more freely, and to file heavy specifications against their contracts. Repeating familiar experience in the steel industry, buying begot buying until at the close of 1912 there was a larger volume of genuine business on the books of the steel producers than ever before in their history.

It required no very large tonnage to fill the mills and take up the slack. In the last quarter of 1911, when the lowest prices for years were reached, the mills were operating at about 75% of capacity, and it required only that actual demand should fill up the gap of 25% to bring about a condition of buyers contracting and specifying farther and farther ahead. The fact should be emphasized that this was no wonderful increase in the country's demands. The pressure upon mills was brought about rather because the increase in productive capacity in immediately preceding years had been abnormally small. For decades demand and production doubled on an average every 10 years. The rule has not been maintained since 1907. The industry experienced a great chill, when, following the panic in October, 1907, demand so decreased that production dropped off more than 50% in three months, when there was much new construction under way and a capacity greater than ever was promised. It was said that it would require a period of years for demand to grow up to capacity. The new construction program of that time was carried out, but little additional was done, which makes it that in the five years from the close of 1907 to the close of 1912, there was a large increase in capacity in the first half of the period, and a very small increase in the second half. The actual production of pig iron in the 12 months ended October, 1907, was 27,000,000 tons. A doubling in 10 years means an increase of 41.6% in five years, and this percentage, added to the 27,000,000 tons, would indicate 38,000,000 tons for 1912. The actual production of the year was about 29,600,000 tons, while the rate of production in the three closing months, the maximum in the year was only a trifle over 32,000,000 tons. The actual capacity was not much greater, for prices could not have advanced as they did, with strictly open-market conditions prevailing, unless substantially all the

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capacity of the well positioned furnaces was engaged. There was some idle capacity, of course, particularly so because some furnaces, otherwise well positioned, could not secure coke except by paying a very high figure. The total capacity of the industry, however, at prices for the product which prevailed at the close of the year, with raw materials priced in proportion, was only about 34,000,000 tons. As the rate of gain in demand and production which prevailed in the past would have produced 28,000,000 tons in 1912, while the capacity was only 34,000,000 tons, and the productive rate at the close only about 32,000,000 tons, it is evident that the pressure upon producers was caused by capacity having grown at an abnormally small rate rather than by demand having grown by any great amount.

AVERAGE PRICES AT PITTSBURGH, 1912.

	Pig Iron				Steel				Nails		
	Bessemer	Basic	No. 2 Foundry	Ferro-manganese	Bessemer Billets	Beams	Plates	Bars	Black Sheets No. 28	Wire per keg	Cut per keg
Jan.	$14.98	$13.27	$13.90	$42.95	$19.75	1.15c.	1.15c.	1.15c.	1.90c.	$1.57	$1.50
Feb.	14.90	13.15	13.90	42.95	19.50	1.11	1.11	1.11	1.85	1.60	1.50
Mar.	14.95	13.66	14.02	42.95	19.75	1.12	1.11	1.10	1.80	1.60	1.55
Apr.	15.15	13.88	14.15	44.49	20.25	1.20	1.20	1.15	1.85	1.60	1.55
May	15.13	13.90	14.15	49.20	21.00	1.25	1.25	1.20	1.90	1.60	1.55
June	15.15	14.11	14.15	50.45	21.25	1.26	1.26	1.21	1.90	1.60	1.55
July	15.15	14.38	14.29	51.22	21.50	1.30	1.30	1.25	1.96	1.62	1.55
Aug.	15.43	14.90	14.79	53.51	22.15	1.37	1.37	1.30	2.03	1.66	1.58
Sept.	16.86	16.03	15.39	57.97	23.75	1.40	1.40	1.31	2.12	1.70	1.60
Oct.	17.90	17.08	16.99	62.23	25.75	1.47	1.47	1.39	2.20	1.70	1.63
Nov.	18.07	17.09	17.74	63.37	26.75	1.50	1.50	1.40	2.25	1.70	1.68
Dec.	18.15	17.40	18.40	66.95	27.00	1.50	1.50	1.40	2.25	1.73	1.70
Year	15.99	14.90	15.16	52.35	22.37	1.30	1.30	1.25	2.00	1.64	1.58
Year 1911	15.72	13.94	14.49	39.20	21.42	1.32	1.31	1.26	2.03	1.70	1.59

Prices of pig iron, ferro-manganese and billets are per ton, 2,240 lb.; of steel products, per pound; of nails, per keg of 100 lb.; ferromanganese and finished steel prices are contract prices for forward delivery.

A few estimates of tonnage in 1912 are made below, comparison being made with 1911, the preceding year, and with 1907, the closing year in the period of exceptional activity which will be so long remembered. The figures refer to gross tons except where otherwise specified.

	1907	1911	1912
Lake Superior iron-ore shipments	42,266,668	32,793,130	48,500,000
Pig-iron production	25,781,361	23,649,547	29,600,000
Steel ingots and castings	23,362,594	23,676,106	31,000,000
Rails	3,633,654	2,822,790	3,500,000
Tinplate	514,775	783,960	900,000
Number of freight cars ordered	151,711	133,117	225,000
Number of freight cars built	284,188	55,931	180,000

The year 1912 closed leaving the iron and steel industry with the brightest prospects for the new year, the mills having about three months of work at full capacity actually specified on books, and contracts covering from three to five months additional. In contracting there had naturally been a decrease, the business having already been placed under cover for such a distance in the future. Without a general decline in industrial activity the course of the iron and steel industry in the first half of 1913 was clearly mapped out, only the second half being in doubt. Inasmuch as the industry was really undersized for a normal consumptive demand, based on the average rate of increase in the past, it was apparent that a slight decrease in demand could occur without causing a marked reversal, whereas any further increase would cause still greater pressure upon the mills and still higher prices.

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The Chicago Iron and Steel Market

BY E. MORRISON

The history of the Chicago iron and steel market in 1912 is the record of a brief period, at the beginning of the year, of light business, falling by February into something of depression but quickly recovering and then increasing steadily to activity probably never before paralleled. This change was chiefly the result of the buying of supplies and equipment by the railroads, after a year in which but little had been bought. At the close of 1912 every manufacturing industry of importance in Chicago territory was running at full capacity. Large crops gave assurance that the industries directly dependent on farming, so numerous in this territory, would have continued prosperity.

Opening with a demand for pig iron superior to that for iron and steel products, the year soon developed an abnormal demand for the manufactured products and a lighter demand, relatively, for pig iron. The end of 1911 had been marked by the usual December light buying; January saw Lake Superior charcoal iron selling at $16@16.50; Northern No. 2 foundry pig iron at $14@14.50 at the furnace and Southern No. 2 foundry iron at $10, Birmingham, or $14.35, Chicago. The cost of Northern iron to the consumer was on the average about 50c. more than the furnace prices, throughout the year. Structural material in January sold as low as 1.30c. and was in light demand; bars were strong with iron bars at 1.15c. minimum and soft-steel bars at 1.25c. minimum, in this month. Sales of pig iron were under 1000 tons each.

Thence on to August increasing activity and larger buying was manifest in the pig-iron market, with a corresponding gain in prices.

In September buying of pig iron became somewhat brisker and by the middle of the month all grades advanced about $1, No. 2 foundry selling at $16.50 for Northern, furnace, and $17.35@17.85, Chicago, for Southern. Sales of charcoal iron increased and the price rose to $17.75@18.25. Structural material advanced to 1.58@1.63c.

Thereafter the market quieted down gradually, mainly because consumers were well supplied. Prices were firm.

UNIT PRICES AT CHICAGO.

	1911		1912	
	Highest	Lowest	Highest	Lowest
Lake Superior Charcoal (Chicago)	$18.50	$16.50	$19.75	$15.75
No. 2 Northern foundry (furnace)	16.50	14.00	18.25	14.00
No. 2 Southern foundry (Chicago)	15.85	14.35	18.85	14.35
Bar Iron	1.35c.	1.15c.	1.60c.	1.15c.
Structural material (3 in. to 15 in. and angles 3 in to 6¼ in. or heavier)	1.63c.	1.30c.	1.83c.	1.25c.

The end of the year developed the customary quiet in the pig-iron market, but there was general satisfaction among both producers and users of pig iron over the outlook for the coming year. Locally the year had been one of great prosperity for all branches of the iron and steel industries and there seemed every prospect of its continuance into the new year.

The Lake Superior Iron Ore District

By Dwight E. Woodbridge*

Iron-ore shipments from the Lake Superior region were heavier in 1912 than ever before; this was in spite of a rather dull-looking year, at its outset. Total water shipments for the year were 47,435,778 gross tons, as against 32,130,413 tons for the preceding season of navigation. These figures are exclusive of Canadian shipments, which reached a total of 100,000 tons for 1912, or 120,000 less than in 1911, and they are exclusive of all rail shipments, which will be in the neighborhood of 900,000 tons. The proportion of shipments by the mines of the U. S. Steel Corporation has been a little less than usual and amounts to 49.5% of the whole. In 1911 this proportion was 52.7% of all. This diminution is somewhat remarkable, as it comes in spite of an enormous tonnage mined from Great Northern leases by the Steel Corporation.

Eleven mines around the Lake produced more than a million tons each; two of these are on old ranges, and one is not the property of the Steel Corporation. These eleven averaged 1,550,000 each, and were led in individual quantities by the Hull, 2,232,180 tons; the Leonard, 2,194,114; and the Canisteo, 2,097,406 tons.

The season was one of low mining costs, low freights both by rail and lake, few losses and a constantly accelerating demand. Labor was fairly plenty, until toward the closce of the year when the war of the Balkan allies drew many foreigners home, and labor was well remunerated for its work. The institution of safety devices at mines reduced the number and extent of personal injuries among miners. As it was the first year in which there had been a general tendency toward safety precautions this result is most gratifying. In Minnesota fatalities were 16% fewer in 1911, although there was one very unusual accident in which no less than 15 men lost their lives. Nonfatal accidents dropped off 35%, in spite of the fact that more men were engaged in mining. The fleet of great-lake ships, though increased but slightly over 1911 and though called upon to move a greater volume of grain and coal than ever before, was ample to care for the enormous traffic in ore, and can easily handle, without additions, many more million tons than it was called on to care for during the year. As a result, the construction of new ships is slow this winter. With the exception of two for the Steel Corporation and a few others, the fleet for freight traffic will be unchanged in 1913. Ore prices will be higher by about 65c. a ton and lake freights will advance by 5c.

Great Northern Lease

The Steel Corporation showed the greatest activity in handling ore from its Great Northern lease, which is soon to expire and under which it had paid nearly $3,000,000 in advance royalties. It took out, not alone the 4,500,000 tons of the year's minimum, but all the accrued deficiencies, thus ending the year on an even keel, so far as these advance royalties was concerned. The total shipments out of mines in which the Great Northern has all or a part interest amounted to about 9,000,000 tons, but interests in some of the mines shipping this are owned by others than the Great Northern and its associated lessors. Shipments to be credited to the lease were about 7,000,000 tons. If this rate can be maintained for the two seasons remaining gross shipments of the term will exceed considerably the minimum of the leasehold.

New Explorations on the Cuyuna

Explorations in 1912 were chiefly confined to the Cuyuna and Menominee ranges, with some less important work on the Vermillion and Mesabi. In the eight or nine years since the Cuyuna was discovered no single twelve months witnessed as great development. The nature of the district is better understood and there were more explorations than before. It is difficult to state the tonnage of ore found in 1912, but it is safe to say that there now exist in the Cuyuna more than 250,000,000 tons of ore, in addition to which are far greater quantities of ore material too low to be mineable at present or without treatment. Though shipments from the Cuyuna for the year were but 305,000 tons, they bid fair to be very much greater the coming summer. Opened mines are the Kennedy (Sec. 30, 47-28), the Meacham, Thompson and Armour No. 2 (all in Sec. 11, 46-29), the Armour No. 1 (Sec. 10, 46-29), the Cuyuna Mille Lacs (Sec. 3, 46-29), the Adams (Sec. 30, 46-28), and the Barrows (Sec. 30, 44-21). All these will ship the coming season. In addition to them is the Pennington mine of Tod, Stambaugh & Co. in Sec. 10, 46-29, and the Carlson-Williams property in Sec. 18, same township. The peculiarity of these last named two is that they are stripped for open-cut mining.

At the Pennington mine, the removal of a million yards of overburden will expose for mining a like tonnage that can be taken by steam shovel, and a further million tons that is available for "milling." The royalty on this property exceeds any other in the district, being at the rate of 80c. per ton, but it is not greatly higher than has just been paid by the Northern Pacific road for a developed tract in the same township, which was sold at 70c. per ton. Just now these figures seem to be very high. Stripping at the Pennington mine is to be done by steam shovel, at the Carlson property it is by hydraulic giants. These loosen the material, which is afterward handled to a slope by a centrifugal pump. A similar process is to be undertaken at another property in the same neighborhood.

In a certain restricted district of the Cuyuna, centering about Sec. 3, 46-29, considerable deposits of manganiferous iron ore were found and opened by several companies, one of which has commenced shipment of some small orders. It is claimed that these shipments have been at considerable profit to the mining company, and that orders for a large amount have been received as the result. It is difficult, as yet, to gage the value of these discoveries of manganese, for the ore is spotty and irregular, not usually bessemer and carries a manganese content up to say, 18 to 20%, with a combined iron and manganese of say, 55 to 80%. The Cuyuna Mille Lacs is said to have shipped five carloads averaging 31% Mn and 30% Fe. The manganiferous district as so far determined includes parts of sections 3, 4, 10 and 11, town-

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ships 46-29, and of sections 22, 33 and 34, township 47-29. A little ore running better than 50% has been found in section 33, 47-29.

In anticipation of a greater business from the Cuyuna the Soo Line is extending its shipping piers to double its present size, and the Northern Pacific is preparing to construct a steel and concrete pier similar, in all but size, to those of the Great Northern road at Superior. It is apparent that the Northern Pacific road intends to go into the business of mining either through its Northwestern Improvement Co. or by arrangement with outside interests. It has grouped a large acreage of Cuyuna lands, on some of which it has been paying royalties for years.

Vermilion Range

Explorations on the Vermilion range seem to have demonstrated the probability of two mines, on lands of the Vermilion Iron & Steel Co., northeast of Vermilion Lake, and on the property of the Vermilion & Mesabi Iron Co., a mile south of Ely. To both of these railroad connection will soon be made. Most of the other work that was in progress a year ago was stopped, and little favorable information is at hand on that which continues.

For many years the Vermilion range has been a one-company district, all its mines having been the properties of the Oliver Iron Mining Co. But this is changed. Of shipments of 1,840,215 tons for the last year, 227,391 tons were from independent shippers, the Section 30 company, 153,991 tons; the Chandler, 73,370, and the White Iron Lake Co., 30 tons. During 1913, the Section 30 company may triple its 1912 shipments and the two favorable explorations referred to above may produce a little ore. Both are arranging for railroad connection and both have a little ore on stockpile.

The Menominee Range

There was much activity in 1912 in the Menominee district. In the Mastodon field, at Palatka, in the Norway section, near Iron River, at Iron Mountain, and elsewhere, there was much development in the way of opening new mines and reworking old shafts and old time mines that had been idle for a long time. The district is looking exceptionally well, and will increase its capacity for production many years. At present it is probable that the Menominee district is the most favorable field for exploration around Lake Superior.

The Marquette Range

In the Marquette district the Cascade section was unusually active, and in addition to the enormous holdings of low-grade ores existing there, good ores are being found and opened for mining on a large scale. In the vicinity of Gwinn and west of Negaunee the Cleveland-Cliffs company added to its operations. Its North Lake mine was developed to an important property, and its Gwinn properties are now beginning to show that they are both good and big. Its Maas mine is increasing and its Negaunee was reëquipped.

The Gogebic Range

There is but little to be said as to the Gogebic district. By the work of R. B. Whiteside and others, of Duluth, the productive portion of the range was lengthened somewhat, these interests now being at work sinking a working shaft some distance to the east of Sunday Lake. The Cleveland-Cliffs company abandoned its Ashland mine lease, held for the last 10 years, and the fee owners are again at work. People will watch with interest to see if these fee holders can duplicate the somewhat marvellous and most remarkable experience they had with this property after it was abandoned by the Rockefeller party, in the fall of 1898. Norris-Aurora and Newport made great records for the year, and the district in general is in most excellent condition, with its many fine steel footwall shafts and its fine surface and underground improvements.

The Mesabi Range

Developments of 1912 in the Mesabi district tended toward the increase in the amount of ore to become available for purchase by independent furnace interests. Exploration was slack and but little new tonnage was developed. However, two great independent mining companies began business, neither with furnace affiliations, and each with a vast tonnage of unopened ores of varying grades, each intending to sell their product on the open market. This is a development of the widest importance. It will relieve the furnace operator, who has not sufficient ore of his own, of the fear that he will be crowded out of the business, and it will have an important bearing on prices of Lake Superior iron ores. These two companies are the Great Northern Ore Properties and the Sargent Land Co. The latter owns a very important share of the ores that were included in the Great Northern lease to the U. S. Steel Corporation, now to be abrogated. The Great Northern Ore Properties is opening three surface mines of good grades of ores, situated in townships 58-19, 58-20 and 57-21, and is to open others, part surface and part underground. It is the intention to be able to mine and sell not less than 3,000,000 tons of ore per year, commencing with 1915. The Sargent Land Co. owns what are known as the Pillsbury, Bennett & Longyear lands, on the westerly part of the Mesabi, and it is now opening a large property in Sec. 24, T. 57-22. This will be stripped for steam-shovel mining and a shaft sunk to handle the bulk of the deposit, which is one of the great orebodies of the Mesabi. The same interests control a great deposit of good ore in 58-15, as well as large tracts of land that have not yet been taken out of the Great Northern leasehold. As the Cascade Mining Co., they also have an important mine on the Marquette range that is being opened by the sinking of a large shaft which must go down nearly 900 ft. to the ore. They also control properties near Crystal Falls that are under preliminary development. This company can be as large a shipper as the Great Northern and will be able to produce ores of varying characteristics.

Changes in the treatment of ores and new plants will be described in a later article.

The total shipments of the Oliver Iron Co., the ore subsidiary of the Steel Corporation, were 23,840,237 tons, of which 18,569,545 tons were from the Mesabi Range, a large part coming from the Great Northern leases.

The important changes during 1912 included the reduction of freight rates on ore from the mines to the shipping ports, made by order of the Interstate Commerce Commission. The reduction was from 80 to 60c. per ton and covers all shipments from the Mesabi.

Chronology of Mining in 1912

JANUARY

Jan. 2—Picher Lead Co. secured control of the lead smelteries at Webb City, Mo., and Galena, Kansas.

Jan. 6—Mason Valley smeltery at Thompson, Nev., was blown in.—Organization of Inspiration Consolidated Mining Company.

Jan. 9—Six men were killed and two injured by an explosion of dynamite in the Parrish mine, near Plymouth, Penn.

Jan. 11—Lehigh Valley R.R. announced plan to separate the railroad from its coal properties.—An anti-Japanese riot at Hayden, Arizona.

Jan. 15—Converters at Braden mines in Chile were started.—Utah Copper Co. placed the seventh section of the Arthur mill in commission.

Jan. 16—Two men were killed by a falling timber in Kingdon shaft of Old Dominion company.

Jan. 17—Four men were killed in a mine of the Central City Coal & Iron Co. at Central City, Kentucky.

Jan. 18—Vote of British miners was announced as 445,801 for a strike on Mar. 1, and 115,921 against.

Jan. 20—Fire at loading station of the Daly West and Ontario mines in Utah, caused loss of about $20,000 and necessitated temporary shutdown of the Daly West.

Jan. 21—Five men were reported killed or injured in a dust explosion at No. 4 mine of Kemmerer Coal Co., at Kemmerer, Wyoming.

Jan. 31—Fire destroyed surface works at the W. Y. O. D. mine, near Grass Valley, Calif.; $30,000 loss.

FEBRUARY

Feb. 7—Sixty-eight miners, temporarily imprisoned in Bunker Hill mine, California, by a falling skip which blocked the shaft.

Feb. 12—An accident in a coal mine at Antonienhütte, Prussia, reported to have killed 27 men.

Feb. 15—Smelting resumed by the Consolidated Arizona Smelting Co., at Humboldt, Arizona.

Feb. 19—Announcement of initial dividend of $1,000,000 by the Bonanza copper mine, Alaska.

Feb. 23—Eight men killed and 20 injured in a fire at No. 5 mine of the Western Coal & Mining Co., at Lehigh, Okla.—Sixth section of the Miami mill was placed in operation, giving the mill its full capacity.

Feb. 26— The U. S. District Court at Trenton, N. J., decided that the Butters filter was not an infringement of the Moore filter, in the suit of the Moore Filter Co. against the Tonapah-Belmont Development Company.

Feb. 28—Ray Consolidated stockholders voted to increase stock to 1,600,000 shares, to absorb the Ray Central company.

Feb. 29—British coal-miners' strike was inaugurated, before official time, by a walkout of about 800,000 men.—First furnace of the lead smeltery of the International Smelting & Refining Co. blown in.

MARCH

Mar. 1—Dissolution of the Butte Coalition company, its property passing to the Anaconda company.

Mar. 2—President Taft issued a proclamation respecting the troubles in Mexico, advising American residents to keep out of them.

Mar. 4—The Supreme Court announced its decision to review the action of the Ninth U. S. Circuit Court of Appeals, which denied relief to the farmers of Deer Lodge Valley from the fumes of the smeltery at Anaconda, Montana.

Mar. 7—Fire partially destroyed the Mogul cyanide plant in the Black Hills, South Dakota; $75,000 damage, covered by insurance.—An explosion in the mine of the Diamond Vale Collieries Co., at Merritt, B. C., killed seven men.

Mar. 11—The McIntyre 10-stamp mill, at Porcupine, commenced operation, becoming the first regular producer of bullion in the district.

Mar. 14—A snowslide killed four men at the Black Bear mine, in the San Juan region, Colorado.

Mar. 15—The Arizona Commercial Copper Co. went into the hands of a receiver, in default of interest on a $1,000,000 bond issue.

Mar. 16—An explosion was reported to have killed 45 men in the Italianka coal mine, in Russia.

Mar. 18—The smeltery of the American Smelting & Refining Co., at Durango, Colo., was blown in after a shutdown since November.

Mar. 20—An explosion in the Chant No. 2 mine of the Sans Bois Coal Co., at McCurtain, Okla., killed 74 men.

Mar. 26—An explosion at the Jed Coal & Coke Co.'s Jed mine, two miles from Welch, W. Va., killed 81 men.

Mar. 31—The Dome mill at Porcupine started.

APRIL

Apr. 1—Miners in Butte decided not to strike by vote of 4460 to 1121—A gold bar of 160 oz. was deposited from the McIntyre mill in a Porcupine bank, being the first commercial product from the Porcupine district.—Miami Copper Co. declared initial dividend.—Inauguration of anthracite coal miners' strike in the United States.

Apr. 2—Stockholders of Chino Copper Co. voted to increase capital stock by 100,000 shares.

Apr. 6—Leaders instructed the striking British coal miners to return to work.

Apr. 10—Sampling plant of the Nipissing company destroyed by fire.

Apr. 18—Trouble at the Lena Goldfields workings at Irkutsk, Russia, resulted in the killing of 107 and wounding of 80 workmen by troops.

Apr. 20—Roasting furnaces put in operation at new Hayden plant of A. S. & R. Co.

Apr. 21—An explosion of gas in the Coil coal mine at Madisonville, Ky., killed five men, all that were in the mine.

Apr. 25—John D. Ryan, president of the Amalgamated company, announced that the company would spend $2,500,000 on reconstruction of the Great Falls smeltery.

Apr. 27—Organization of convention of European aluminum producers.

Apr. 30—An explosion reported to have entombed 283 miners in the Hokkaido Coal Co.'s mine at Yubari, Japan.

MAY

May 1—Giroux company began ore shipments to the Steptoe Valley works.—Strike at the Murray plant of the American Smelting & Refining Co. at Murray, Utah.

May 6—The Eureka & Palisade R.R. resumed operation.

May 10—First lot of electrically smelted pig iron shipped from California to Salt Lake City.

May 13—Strike at Baltimore copper refinery.—Cave-in at Norrie iron mine in Michigan killed seven men.

May 15—First blister copper made at Hayden plant of American Smelting & Refining Co.

May 16—Government filed suit against the Aluminum Co. of America, to restrain it from illegal practices.

May 23—Fire destroyed the stamp mill of the San Miguel Mining Co., Telluride district, Colorado.

JUNE

June 1—United States Smelting, Refining & Mining Co. secured control of the Consolidated Fuel Co.'s lands in Utah, comprising about 5000 acres.—Trial run on Giroux ore begun at Steptoe concentrator.

June 2—A 7000-bbl. gusher of the Pacific Crude Oil Co. in California caught fire and burned six days before extinguished.—Announcement of formation of the Canadian Mining & Exploration Co., Ltd., with a capital of $5,000,000.

June 5-6—Fighting between revolutionists and the employees at the property of the Cuba Copper Co. near Santiago de Cuba.

June 10—Operators in the Globe-Miami district, Arizona, raised wages.

June 13—The Interstate Commerce Commission ruled that interstate pipe lines are common carriers.—The United States Court at Wilmington, Del., issued a final decree ordering the dissolution of the so called powder trust and a division of the business among three companies.—Award of $400,000 damages to the Smuggler-Union company, in Colorado, in its suit against the Liberty Bell mine for trespass.

June 15—The Hollinger mill at Porcupine started.

June 18—Settlement of the strike at the refinery of the American Smelting & Refining Co., at Perth Amboy, N. J.

June 19—An explosion in the Hastings mine of the Victor-American Fuel Co., in Colorado, killed 12 men and injured one.

JULY

July 1—Butte miners voted to accept wage proposition of Anaconda company to pay $4 per day on the basis of 17-c. copper, to be effective June 1.

July 4—An explosion of firedamp in the Osterfield colliery near Oberhausen, Germany, killed 14 miners.

July 7—An explosion of dynamite killed 10 and injured two men loading holes in the Eureka pit of the Nevada Consolidated.—At the Braden copper mine, in Chile, 30 men were killed by a dynamite explosion underground.

July 9—An explosion killed 88 men in the Cadeby colliery in Yorkshire, England, the day after that mine had been visited by King George V.

July 11—An explosion in the Panama colliery of the Ben Franklin Coal Co. at Moundsville, W. Va., killed eight men.—The Arizona Commercial mine was purchased by Charles Smith at public sale for $1,000,000.

July 16—Six miners were killed and three were seriously injured in an explosion at the Gayton colliery of the Old Dominion Development Co., about 20 miles from Richmond, Va.

July 18—A cloudburst in the Seven Troughs district, Nevada, drowned 13 persons and did much damage in the towns of Mazuma and Seven Troughs.

July 21—Standard mill of the Amalgamated Asbestos Co. at Thetford, Que., was destroyed by fire.

July 24—The new mill of the Tonopah-Belmont company commenced operation.—A cloudburst swept away a dam, drowning 13 men in the Superba No. 2 colliery near Uniontown, Penn.

July 25—The smeltery of the Santa Fé Gold & Copper Co. in the San Pedro district, New Mexico, was blown in.

July 26—Three men were burned in the shaft of the No. 3 colliery of the Monon Coal Co., near Linton, Indiana.

July 31—Announcement of the consolidation of the Alaska-Perseverance, Oxford and Sheep Creek properties near Juneau, Alaska, as the Alaska-Gastineau Mining Co.

AUGUST

Aug. 1—An explosion of gas occurred in the colliery of the Washington-Wheatland Coal Co., at Wheatland, Ind., injuring five men, two fatally.

Aug. 2—A premature explosion on the 17th level of the "D" shaft of the Newport mine, at Ironwood, Mich., killed one miner and injured another.

Aug. 3—Festivities celebrating the centenary of the Krupp iron works at Essen.

Aug. 8—An explosion in the Lothringen colliery near Gerthe, Germany, killed 114 and injured 16 men.

Aug. 12—Announcement of the organization of the Alaska Gold Mines Co., to acquire control of the Alaska-Gastineau Mining Co., owning large, low-grade gold deposits near Juneau, Alaska.

Aug. 13—Explosion in the Abernant colliery, 28 miles from Birmingham, Ala., killed 37 men.

Aug. 27—Four miners killed by blackdamp in the Frontier colliery, at Linden, Wis.

Aug. 30—A wooden platform collapsed at a colliery at Gelsenkirchen, in Prussia, allowing six men to fall down the shaft, five of whom were killed.

SEPTEMBER

Sept. 3—Explosion of firedamp in the Clarence colliery, near Bruay, Département du Nord, France, killed 61 men, including some of the rescuers who entered the colliery after the initial explosion.

Sept. 4—Heavy rains flooded the Ruddy mine, at Biwabik, Minn., causing caving at the shaft and entombing three men.

Sept. 5—One man was killed and five slightly injured in an overwinding accident at the Bunker Hill & Sullivan mine, at Kellogg, Idaho.

Sept. 10—Smelting plant of Granby Mining & Smelting Co., at Granby, Mo., destroyed by fire.

Sept. 14—The first sod turned for the East & West Australian railway at Port Augusta.

Sept. 15—Mexican rebels captured the town of El Tigre, Sonora, Mexico, and robbed the Lucky Tiger-Combination Gold Mining Co. of bullion and merchandise.

Sept. 16—One man killed and two injured by an explosion of gas in the Wharton Coal Co. colliery, at Coral, Penn., a few hours after the mine had been declared non-gaseous by official inspectors.

Sept. 18—Miners at Bingham, Utah, went out on strike upon refusal of the companies to advance wages 50c. per shift and recognize the union.

OCTOBER

Oct. 1—Wages increased 25c. per day at Mason Valley mines and smeltery in Nevada.—Nevada Consolidated increased miners' wages 25c. per day.

Oct. 2—Miners in Ely copper district, Nevada, went out on strike for increase in wages of 50c. per day and recognition of the Western Federation of Miners.

Oct. 3—International Smelting & Refining Co.'s refinery at East Chicago, Ind., started.

Oct. 8—Fire in the Bunker Hill & Sullivan mine in the Cœur d'Alene district, Idaho; one life lost.

Oct. 9—Utah Copper Co., and other operators in Bingham Cañon resumed operations on a small scale, virtually signalizing the failure of the strike.

Oct. 12—Fire in the North Mount Lyell mine, Tasmania, imprisoned 90 and caused the death of about 45 men.—Kennecott Mines Co., operating the Bonanza mine in Alaska, declared a dividend of $2,000,000.

Oct. 14—Hollinger Gold Mines, Ltd., of Porcupine, declared initial dividend of 3%, payable Nov. 2.

Oct. 17—Two Greek strikers killed by guards at the Steptoe Valley smeltery, whereupon Governor Oddie declared martial law in effect and called out state police to maintain order in the Ely District.

Oct. 19—New Ophir mill on the Comstock Lode, Nevada, began operations.

Oct. 20—Cuyuna-Mille Lacs company shipped first ore from the Cuyuna Range in Minnesota.—One hundred twenty men went out on strike at the Cobalt Townsite mine.

Oct. 21—United Metals Selling Co., entered the domestic lead market as sales agent for International Smelting & Refining Co.

Oct. 23—Owing to the spread of the fire in the North Mount Lyell mine the management decided to flood it.

Oct. 24—Nevada Consolidated resumed steam-shovel work at Copper Flat with two shovels.—Hoisting engineer at the White raise of the Bunker Hill & Sullivan mine in Idaho, lost control of skip and 12 men were dropped 200 ft. to the bottom; two men were seriously injured.

Oct. 25—Representatives of colliery proprietors and miners agreed upon an advance of one shilling per week in wages, affecting about 400,000 men in the collieries of North Wales and England, excepting Northumberland and Durham.

Oct. 29—Strike at Ely, Nev., declared off by an almost unanimous vote, the men to return to work at an advance of 25c. per day as originally offered by the companies.

NOVEMBER

Nov. 1—Increase announced in pay of employees at Utah Copper mills, and of engineers, firemen and switchmen on Bingham & Garfield Railroad.

Nov. 5—Striking miners at Cobalt-Townsite mine return to work under old conditions.—The U. S. Circuit Court of Appeals for the third circuit reversed the decision of the district court and declared that the Butters filter was an infringement of the Moore process patent in the suit of the Moore Filter Co., against the Tonopah-Belmont Development Company.

Nov. 8—One man killed and five injured by explosion of gas in Simpson-Brooks colliery at Lafayette, Colo.

Nov. 10—A mine captain and a miner overcome by gas in a winze in the Casey-Cobalt mine in Cobalt district, Ont., fell into 4 ft. of water and drowned.

Nov. 11—Concentrator of Nevada Consolidated Copper Co., at McGill, Nev., run at full capacity for first time since strike begun in October.

Nov. 12—Two men killed in strike riots at Waihi gold mine in New Zealand.

Nov. 13—Announcements made that the firm of M. Guggenheim's Sons had joined A. C. Burrage in the exploitation of Chuquicamata copper mines, in Chile.

Nov. 14—Smeltery of American Zinc, Lead & Smelting Co., at Hillsboro, Ill., put in commission.

Nov. 15—Miners at Porcupine, Ont., went out on strike in resistance to proposed reduction of wages.

Nov. 18—Albert Freeman, Josiah Quincy, William J. Morton and Julian Hawthorne brought to trial for alleged use of the mails to defraud in promoting Hawthorne Silver & Iron Mines Co., Ltd., and other companies.

Nov. 19—First production of sulphur at Bryan Heights, Texas, by Freeport Sulphur Co.

Nov. 24—Twenty-four men killed by explosion of gas in the St. Martin de Valgalgues mine, near Alais, in the Department of Gard, France.

Nov. 25—Fifty men caught in a cave-in at Barnum mine, Pittston, Penn.; no fatalities, but about a dozen miners seriously injured.

DECEMBER

Dec. 1—Utah Copper Co. raised wages for surface labor to $2.20 per 10-hr. shift, an advance of 20c. per day, to continue so long as the average monthly price of copper remains above 17 cents.

Dec. 3—Perseverance stamp mill at Alaska Gold Mines property near Juneau was destroyed by fire.—T. S. Crosley, of New York, bought holdings of La France Copper Co. at auction.

Dec. 9—Archie L. Wisner, head of the stock brokerage concern of A. L. Wisner & Co., and John J. Myers placed on trial on indictments charging use of the mails in defrauding investors in mining stocks.—A snowslide on Copper Mountain, near Cordova, Alaska, carried away seven buildings on the property of the Great Northern Development Co., and killed nine men.

Dec. 10—Fire in the West Stewart mine at Butte, a property of the Anaconda Copper Mining Co.

Dec. 12—Twentieth Century and Jajola combined mine plant at Cobalt destroyed by fire.

Dec. 18—Strike at Cananea, Mexico, for increase in wage and a shorter day.—Explosion in Achenbach coal mine, near Dortmund, Germany, killed 31 men.

Dec. 23—Fire imprisoned 35 men in the Nelson tunnel of the Happy Thought mine at Creede, Colo., escape being effected through a connecting mine.—About 200 Japanese miners were killed by an explosion in the Ubari colliery at Sapporo, on the island of Hokkaido, this being the second serious explosion in this district this year.

Dec. 26—Strike at Cananea reported broken and mines and smeltery resumed operations.

Dec. 27—Interstate Commerce Commission ordered an increase in the all-rail freight rate on copper from Lake Superior to New York.

Dividends Paid by Mining Companies in 1912

The tables published herewith show the dividends paid in 1911, 1912 and to date by the principal mining, metallurgical and holding companies of America. As regards the United States mining companies, the list includes all large companies paying dividends after 1906, except a few companies completely absorbed before 1911, but no effort has been made to include mines which have paid no dividends since 1906.

The total dividends, $67,832,433, reported in 1912 for United States mining companies, while an increase of over $10,000,000 over 1911 by no means shows the total returns from United States mines, for such companies as the New Jersey Zinc Co., and the Hercules Mining Co., known to be highly profitable, take the stand that information as to profits is not the right of the public.

The Mexican mines listed are those in which United States capital seems most interested. Drawing this line is to some extent a matter of opinion, and as drawn, excludes many noted dividend payers, as: Boleo, Alacran, San Felipe, Santa Maria de la Paz, Naica, etc. In the Canadian field, a few industrials have been included, by request of interested subscribers, but no claim is made that the Canadian metallurgical field is covered completely, although it is believed that the mines are. The same is true with many American coal and iron companies, the list is fairly representative, but it is not complete.

In considering the totals it may also be remembered that while certain close corporations withhold their figures, as has been said, the given figures include a certain amount of duplication, through holding companies and their subsidiaries.

However, the totals which are after all comparative, as they are based on the same companies, showing an increase from $56,971,791 to $67,832,443 for the United States mining companies, from $94,044,899 to $99,599,094 for coal, iron, industrial and holding companies, and from $15,934,911 to $21,130,597 for the foreign companies listed, cannot but be most gratifying to everyone connected with the mining industry.

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES

NAME OF COMPANY AND SITUATION		SHARES Issued	Par Value	DIVIDENDS PAID 1911 Per Share	1911 Total	1912 Per Share	1912 Total	To Date Total	Latest Date	Latest Amount
Acacia, g	Colo.	1,438,989	$ 1	$0.00½	$7,195	.....	.....	$122,004	Jan. '11	$0.00½
Adams, s.l.c	Colo.	80,000	10	.....	.....	.....	.....	778,000	Dec. '09	0.04
Ahmeek, c	Mich.	50,000	25	2.00	100,000	18.00	900,000	1,000,000	Oct. '12	6.00
Alaska Goldfields	Alas.	250,000	5	.....	.....	.....	.....	342,500	Jan. '10	0.15
Alaska Mexican, g	Alas.	180,000	5	0.70	126,000	1.25	225,000	3,093,381	Nov. '12	0.30
Alaska Treadwell, g	Alas.	200,000	25	2.00	400,000	3.25	650,000	12,785,000	Nov. '12	1.00
Alaska United, g	Alas.	180,200	5	0.45	81,090	1.80	324,360	1,062,290	Nov. '12	0.50
Am. Zinc, Lead & Sm	Kan.	165,360	25	2.00	160,240	2.00	248,860	938,900	Oct. '12	0.50
Anaconda, c	Mont.	6,000,000	25	2.00	8,608,750	2.25	9,804,375	68,420,625	Oct. '12	0.75
Argonaut, g	Calif.	200,000	5	.....	.....	.....	.....	1,200,000	June '10	0.05
Arizona Copper, pf	Ariz.	1,266,120	1.20	*a*	119,221	*a*	119,221	1,771,400	Nov. '12	*a*
Arizona Copper, com	Ariz.	1,519,896	1.20	*b*	461,668	*b*	921,389	14,691,805	July '12	0.30
Bagdad-Chase, g., pf	Calif.	84,819	5	.....	.....	.....	.....	202,394	Jan. '09	0.10
Bald Butte, g.s	Mont.	250,000	1	.....	.....	.....	.....	1,354,648	Oct. '07	0.04
Baltic, c	Mich.	100,000	25	5.00	500,000	7.00	700,000	7,750,000	Dec. '12	5.00
Beck Tunnel, g.s.l	Utah	1,000,000	0.10	.....	.....	.....	.....	940,000	Oct. '09	0.02
Benton, z.l	Wis.	196,607	1	.....	.....	.....	.....	10,949	Oct. '08	0.01½
Bingham-New Haven, c	Utah.	228,690	5	0.80	197,812	0.30	68,607	294,219	July '12	0.10
Board of Trade, z	Wis.	120,000	1	0.05	6,000	.....	.....	78,000	Jan. '11	0.05
Bonanza Dev	Colo.	300,000	1	0.20	60,000	.....	.....	1,425,000	Oct '11	0.20
Boston-Sunshine, g	Utah	150,200	1	0.03¾	5,632	.....	.....	27,261	Nov. '11	0.03¾
Boston & Montana, c	Mont.	150,000	25	4.00	600,000	.....	.....	71,825,000	Feb. '11	4.00
Bull., Beck & Champ., g	Utah	100,000	10	.....	.....	.....	.....	2,728,400	July '08	0.10
Butte Alex. Scott, c	Mont.	74,000	10.00	.....	.....	1.00	74,000	74,000	Nov. '12	0.50
Bunker Hill Con., g	Calif.	200,000	1	0.52½	105,000	0.87½	175,000	686,000	Dec. '12	0.05
Bunker Hill & Sull., l.s	Ida.	327,000	10	2.65	866,550	2.45	752,100	13,911,750	Dec. '12	0.20
Butte & Ballaklava, c	Mont.	250,000	10	.....	.....	.....	.....	125,000	Aug. '10	0.50
Caledonia	Ida.	1,300,300	1	.....	.....	.....	.....	52,000	June '10	0.01
Calumet & Arizona, c	Ariz.	550,000	10	4.00	2,150,000	4.25	2,534,500	c16,223,559	Dec. '12	1.25
Calumet & Hecla, c	Mich.	100,000	25	24.00	2,400,000	42.00	4,200,000	120,050,000	Dec. '12	12.00
Camp Bird, g.s	Colo.	1,100,051	5	0.48	534,600	0.96	1,240,407	9,554,407	Dec. '12	0.24
Centennial-Eur., l.s.g.c	Utah	100,000	5	6.00	600,000	3.00	300,000	3,600,000	Oct. '12	1.50
Center Creek, l.z	Mo.	100,000	10	0.15	15,000	0.20	20,000	445,000	Oct. '12	0.05
Champion, c	Mich.	100,000	25	5.00	500,000	12.00	1,200,000	7,600,000	Dec. '12	1.00
Cliff, g	Alas.	100,000	1	0.50	50,000	0.20	20,000	180,000	Nov. '12	0.05
Cliff, s.l	Utah	300,000	1	0.20	60,000	0.10	30,000	90,000	Jan. '12	0.05
Colo. Gold Dredging	Colo.	100,000	10	0.25	25,000	0.75	75,000	200,000	Nov. '12	0.25
Colorado, l.s.g	Utah	1,000,000	0.20	0.12	120,000	0.12	120,000	2,570,000	Dec. '12	0.03
Columbus Con., l.g.s	Utah	285,540	5	.....	.....	.....	.....	212,623	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	.....	.....	.....	.....	43,750	Dec. '09	0.00½
Comstock Phoenix, s	Nev.	800,000	1	0.05	40,000	.....	.....	40,000	Nov. '11	0.05
Con. Mercur., g	Utah	1,000,000	1	.....	.....	0.03	30,000	3,415,313	July '12	0.03
Continental, z.l	Mo.	22,000	25	0.50	11,000	1.00	22,000	275,000	July '12	0.50
Copper Range Con., c	Mich.	384,185	100	3.50	1,357,104	2.00	786,892	12,900,711	Oct. '12	0.50
Daly-Judge, s.l	Utah	300,000	1	0.15	45,000	0.75	225,000	495,000	Dec. '12	0.15
Daly West, s.l	Utah	180,000	20	0.90	162,000	1.20	216,000	6,579,000	Oct. '12	0.15
De Lamar, g.s	Ida.	80,000	5	0.25	20,000	.....	.....	865,000	Aug. '11	0.25
Dr. Jack Pot Con., g	Colo.	3,000,000	0.10	0.00½	15,000	.....	.....	45,000	Mar. '11	0.00½
Doe Run, l	Mo.	65,782	100	6.00	394,698	6.00	394,698	3,237,869	Dec. '12	1.50
Elkton Con., g	Colo.	2,500,000	1	0.06	150,000	0.06	150,000	3,079,460	Nov. '12	0.02
El Paso, g	Colo.	490,000	5	0.01	24,500	0.13	132,500	1,597,295	Oct. '12	0.10
Ernestina	N. M.	300,000	5	.....	.....	0.40	120,000	120,000	Dec. '12	0.05
Federal M. & Sm., com	Ida.	60,000	100	.....	.....	.....	.....	2,708,750	Jan. '09	1.50
Federal M. & Sm., pf	Ida.	120,000	100	7.00	839,027	6.00	749,131	7,675,968	Dec. '12	1.50
Florence, g	Nev.	1,050,000	1	0.10	105,000	.....	.....	840,000	Apr. '11	0.10
Frances Mohawk, g	Nev.	912,000	1	.....	.....	.....	.....	546,000	Jan. '08	0.05
Free Coinage, g	Colo.	10,000	100	.....	.....	.....	.....	180,000	Dec. '09	1.00
Fremont Con., g	Calif.	200,000	2 50	0.20	40,000	0.24	48,000	170,000	Dec. '12	0.02
Frontier, z	Wis.	1,250	100	35.00	42,745	24.00	30,000	147,085	Dec. '12	2.00
Gemini-Keystone	Utah	5,000	100	6.00	30,000	6.00	30,000	2,060,000	Nov. '12	6.00
Gold Coin of Victor	Colo.	1,000,000	1	.....	.....	.....	.....	1,350,000	Feb. '09	0.02
Gold Dollar Con.,g	Colo.	2,500,000	1	.....	.....	0.02	50,000	100,000	Dec. '12	0.00½
Gold King Con., g	Colo.	5,750,370	1	0.03	172,511	.....	.....	1,407,319	Dec '11	0.03
Gold Sovereign	Colo.	1,800,000	1	.....	.....	0.00½	4,500	31,571	Nov. 12	0.00½
Golden Cycle, g	Colo.	1,500,000	1	1.00	1,500,000	0.24	360,000	2,190,000	Dec. '12	0.02
Golden Star, g	Ariz.	400,000	5	.....	.....	.....	.....	140,000	Mar. '10	0.05
Gold Chain, g	Utah	.....	.....	.....	.....	0.07	70,000	70,000	Dec. '12	0.03
Goldfield Alamo, s.l	Nev.	700,000	1	.....	.....	.....	.....	42,000	Mar. '10	0.03

DIVIDENDS OF MINING COMPANIES IN THE UNITED STATES—(Continued)

NAME OF COMPANY AND SITUATION		SHARES Issued	Par Value	DIVIDENDS PAID 1911 Per Share	1911 Total	1912 Per Share	1912 Total	To Date Total	Latest Date	Latest Amount
Goldfield Comb. Fra., g.	Nev.	922,000	1	.....	.....	.....	.....	92,111	Nov. '09	0.10
Goldfield Con., g.	Nev.	3,558,367	10	2.00	7,117,696	1.60	5,694,294	23,839,066	Oct. '12	0.30
Grand Central, g.	Utah	500,000	1	0.02½	12,500	0.10	50,000	1,470,750	Oct. '12	0.05
Granite, g.	Colo.	1,650,000	1	.....	.....	0.01	16,500	269,000	Nov. '12	0.01
Hazel, g.	Calif.	900,000	1	.....	.....	0.07	63,000	873,000	Nov. '12	0.01
Hecla, l.s.	Ida.	1,000,000	0.25	0.24	240,000	0.30	300,000	2,650,000	Dec. '12	0.05
Hercules, l.s.	Ida.	1,000,000	1	0.15	150,000	.....	.....	3,650,000	July '11	0.06
Homestake, g.	S.D.	218,400	100	6.00	1,310,400	6.00	1,310,400	28,849,640	Dec. '12	0.50
Horn Silver, s.c.z.l.	Utah	400,000	25	.....	.....	.....	.....	5,642,000	Sept. '07	0.05
Insurgent, g.	Wash.	100,000	1	0.12½	12,500	.....	.....	25,000	Dec. '11	0.12½
Iowa-Tiger, g.s.l.	Colo.	12,655	1	.....	.....	0.31½	4,058	28,102	Sept. '12	0.11½
Iowa, g.s.l.	Colo.	1,666,667	1	0.01	16,667	0.00½	8,333	208,449	June '12	0.00½
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	0.32	320,000	0.37	370,000	1,370,000	Oct. '12	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	0.20	100,000	0.40	200,000	4,650,000	Oct. '12	0.10
Jamison, g.	Calif.	390,000	10	0.02	7,800	.....	.....	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	0.10	25,000	0.10	25,000	175,000	Aug. '12	0.01
Jumbo Ext., g.s.	Nev.	971,657	1	0.10	97,166	.....	.....	97,166	July '11	0.10
Kendall, g.	Mont.	500,000	5	0.08	40,000	0.10	50,000	1,475,000	Nov. '12	0.10
Kennedy, g.	Calif.	100,000	100	.....	.....	.....	.....	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	.....	.....	.....	.....	396,000	Aug. '09	0.12
Klar-Piquette, z.l.	Wis.	20,000	1	3.62½	72,500	3.75	75,000	162,500	Dec. '12	0.50
Kennicott, c.	Alas.	20,000	100	.....	.....	150.00	3,000,000	3,000,000	Oct. '12	100.00
Knob Hill, g.	Wash	1,000,000	3	0.03½	35,000	0.01	10,000	45,000	May '12	0.00½
Liberty Bell, g.	Colo.	130,551	5	.....	.....	.....	.....	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah	300,000	1	.....	.....	.....	.....	60,000	Sept. '10	0.05
Little Florence, g.	Nev.	1,000,000	1	.....	.....	.....	.....	430,000	Jan. '08	0.03
MacNamara, s.g.	Nev.	728,341	1	.....	.....	.....	.....	40,213	May '10	0.02½
Mammoth, g.s.c.	Utah	400,000	25	.....	.....	0.15	60,000	2,280,000	Oct. '12	0.15
Manhattan-Big Four, g.	Nev.	762,000	1	0.04	30,480	.....	.....	30,480	Aug. '11	0.02
Mary McKinney, g.	Colo.	1,309,252	1	.....	.....	0.06	78,555	972,918	Oct. '12	0.02
May Day, g.s.l.	Utah	800,000	0.25	.....	.....	.....	.....	108,000	Sept. '08	0.01½
Mexican, s.	Nev.	201,600	2.50	0.10	20,160	.....	.....	20,160	Aug. '11	0.10
Miami, c.	Ariz.	664,993	5	.....	.....	1.50	997,489	997,489	Nov. '12	0.50
Mohawk Min. Co., c.	Mich.	100,000	25	1.75	175,000	3.50	350,000	2,675,000	Aug. '12	2.50
Monarch-Madonna, g.s.l.	Colo.	1,000,000	1.00	0.02	20,000	.....	.....	40,000	May '11	0.10
Montana-Tonopah, s.g.	Nev.	921,865	1	0.12	110,624	0.20	184,373	488,588	Dec. '12	0.10
Moscow M. & M., g.s.c.z.	Utah	797,601	1.00	0.02	15,952	.....	.....	15,952	Dec. '11	0.01
Modoc, g.s.	Colo.	500,000	1.00	0.02	10,000	.....	.....	275,000	Dec. '11	0.01
Mountain, g.s.	Calif.	250,000	25	.....	.....	.....	.....	4,216,250	May '08	0.44
Napa Con., q.	Calif.	100,000	7	0.40	40,000	.....	.....	1,840,000	July '11	0.40
National, g.	Nev.	750,000	1	.....	.....	.....	.....	360,000	Sept. '10	0.05
Nevada Con., c.	Nev.	1,995,547	5	1.50	2,957,538	2.00	3,998,837	10,728,377	Dec. '12	0.87½
Nevada Hills, g.	Nev.	746,000	5	.....	.....	.....	.....	373,000	Dec. '07	0.10
New Century, z.l.	Mo.	330,000	1	.....	.....	.....	.....	237,600	Oct. '09	0.01
New Idria, q.	Calif.	100,000	5	1.60	160,000	2.10	210,000	1,660,000	Dec. '12	0.30
North Butte, c.	Mont.	410,000	15	1.20	492,000	1.70	697,000	10,455,000	Oct. '12	0.50
North Star, g.	Calif.	250,000	10	1.70	425,000	1.20	300,000	3,786,986	Dec. '12	0.50
Old Dominion M. & Sm.	Ariz.	162,000	25	3.00	486,000	4.50	729,000	2,551,500	Oct. '12	1.25
Ophir, s.g.	Nev.	201,600	3	0.10	20,160	0.10	20,160	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	0.01	8,990	0.06	53,938	62,927	July '12	0.02
Oroville Dredging	Calif.	700,000	5	.....	.....	.....	.....	1,383,037	Dec. '09	0.12½
Osceola, c.	Mich.	96,150	25	7.50	721,125	12.50	1,201,875	10,881,650	Oct. '12	3.00
Osceola, l.z.	Mo.	98,000	5	.....	.....	0.07½	7,350	252,350	Oct. '12	0.07½
Parrot, c.	Mont.	229,850	10	0.60	137,908	0.60	137,908	7,152,419	Nov. '12	0.15
Pearl Con.,g.	Wash.	1,909,711	0.05	.....	.....	.....	.....	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	.....	.....	.....	.....	87,500	Feb. '10	0.01½
Pioneer, g.	Alas.	5,000,000	1	0.03	150,000	.....	.....	2,041,526	Oct. '11	0.03
Optimo, z.	Wis.	490	100	6.00	2,940	43.00	21,070	24,010	Nov. '12	5.00
Pittsburgh-Idaho, l.	Ida.	1,000,000	1	0.07	56,210	0.20	160,600	216,180	Oct. '12	0.04
Pittsburgh-Silver Peak, g.	Nev.	2,790,000	1	.....	.....	0.02	502,200	502,200	Oct. '12	0.02
Portland, g.	Colo.	3,000,000	1	0.06	180,000	0.06	180,000	9,157,080	Oct. '12	0.02
Quartette, g.s.	Nev.	101,000	10	.....	.....	.....	.....	430,000	Sept. '07	0.10
Quilp, g.	Wash.	1,500,000	1	0.02	30,000	0.01	15,000	67,500	Feb. '12	0.01
Quincy, c.	Mich.	110,000	25	4.00	440,000	5.00	550,000	20,470,000	Dec. '12	1.50
Republic, g.	Wash.	8,500,000	1	.....	.....	0.01	85,000	170,000	Nov. '12	0.01
Rochester, l.z.	Mo.	4,900	100	.....	.....	0.50	2,450	190,846	July '12	0.50
Round Mt., g.	Nev.	866,426	1	.....	.....	.....	.....	328,404	Sept. '10	0.04
St. Joseph, l.	Mo.	1,000,000	10	0.60	600,000	0.60	600,000	8,558,357	Dec. '12	0.15
Seven Tr. Coalition, g.	Nev.	1,500,000	1	.....	.....	0.02½	37,500	37,500	July '12	0.02½
Shannon, c.	Ariz.	300,000	10	.....	.....	0.50	150,000	600,000	Oct '12	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1.00	350,000	.....	.....	1,050,000	Jan. '11	1.00
Silver King Coalition, l.s.	Utah	1,250,000	5	.....	.....	0.25	312,500	1,971,885	Dec. '12	0.15
Sioux Con., l.s.g.	Utah	746,389	1	0.12	89,448	.....	.....	872,097	July '11	0.04
Skidoo, g.	Calif.	1,000,000	5	0.07½	75,000	0.05	50,000	275,000	May '12	0.05
Snowstorm, c.g.	Ida.	1,500,000	1	.....	.....	0.05	75,000	1,084,670	Oct. '12	0.03
Standard Con., g.s.	Calif.	178,394	10	.....	.....	0.10	17,893	5,229,809	Jan. '12	0.10
Stratton's Ind., g.	Colo.	1,000,000	0.60	0.06	60,625	0.12	121,500	425,450	Nov. '12	0.06
Success	Ida.	1,500,000	1	0.05	75,000	0.13	195,000	880,000	Dec. '12	0.01
Superior & Pitts. c.	Ariz.	1,499,792	10	1.16	1,739,759	1.28	1,919,737	3,659,496	Dec. '12	0.38
Tamarack, c.	Mich.	60,000	25	.....	.....	.....	.....	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	1.50	300,000	2.50	500,000	3,106,250	Aug. '12	1.00
Tomboy, g.s.	Colo.	300,000	4.86	0.72	216,000	0.48	145,800	2,993,760	Dec. '12	0.24
Tonopah-Belmont, s.g.	Nev.	1,500,000	1	0.90	1,350,000	1.00	1,500,000	3,593,003	Oct. '12	0.25
Tonopah Ext., g.s.	Nev.	943,433	1	.....	.....	0.05	47,172	330,202	Oct. '12	0.02½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	1.60	1,600,000	1.60	1,600,000	9,650,000	Oct. '12	0.40
Tri-Mountain, c.	Mich.	100,000	25	.....	.....	3.00	300,000	1,250,000	Dec. '12	3.00
Tuolumne, c.	Mont.	800,000	1	0.45	360,000	.....	.....	360,000	Aug. '11	0.15
Tom Reed, g.	Ariz.	909,555	1	0.50	454,778	0.57	518,445	1,009,691	Dec. '12	0.07
Uncle Sam, g.s.l.	Utah	500,000	1	0.15	75,000	.....	.....	470,000	Sept. '11	0.05
United Copper, com.	Mont.	450,000	100	.....	.....	.....	.....	5,962,500	Aug. '07	1.75
United Copper, pf.	Mont.	50,000	100	.....	.....	.....	.....	1,500,000	May '07	3.00
United, z.l., com.	Mo.	92,400	5	.....	.....	.....	.....	27,490	Oct. '08	0.05
United, z.l., pf.	Mo.	19,556	25	.....	.....	.....	.....	312,782	Jan. '08	0.50
United (Crip. Ck.) g.	Colo.	4,000,100	1	.....	.....	.....	.....	440,435	Jan .'10	0.04
United, c.	Wash.	1,000,000	1	.....	.....	0.05	50,000	50,000	Dec. '12	0.01
United Globe, c.	Ariz.	23,000	100	5.00	115,000	20.00	460,000	839,500	Oct. '12	7.50
United Verde, c.	Ariz.	300,000	10	8.25	2,475,000	6.75	2,025,000	31,897,000	Dec. '12	0.75
Utah (Fish Spr'gs.), s.l.	Utah	100,000	10	.....	.....	.....	.....	281,860	Dec. '10	0.02
Utah Copper, c.	Utah	1,562,599	10	3.00	4,703,022	3.00	4,727,458	16,420,920	Dec. '12	0.75
Utah Con., c.	Utah	300,000	5	0.50	150,000	1.50	450,000	7,500,000	Dec. '12	1.00
Valley View, g.	Colo.	1,000,000	1	.....	.....	.....	.....	240,000	Dec. '12	0.04
Victoria, g.s.l.	Utah	251,000	1	.....	.....	.....	.....	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	0.09	135,000	0.12	180,000	2,587,500	Oct. '12	0.03
Wasp No. 2, g.	S.D.	500,000	1	0.07	35,000	0.17	85,000	381,695	Dec. '12	0.10
Wellington, g.	Colo.	10,000,000	1	0.01	100,000	0.01	100,000	200,000	July '12	0.00½
Wolverine, c.	Mich.	60,000	25	9.00	540,000	10.00	600,000	7,440,000	Oct. '12	5.00
Work, g.	Colo.	1,500,000	1	.....	.....	.....	.....	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	.....	.....	.....	.....	1,417,685	Oct. '10	0.04
Yankee Con., s.l.g.	Utah	1,000,000	1	.....	.....	.....	.....	182,500	Jan. '07	0.01½
Yellow Aster, g.	Calif.	100,000	10	0.05	5,000	0.50	50,000	1,126,789	Nov. '12	0.02
Yellow Pine, z.l.s.	Nev.	950,000	1	.....	.....	0.13	123,508	123,509	Dec. '12	0.02
Yukon Gold, g.	Alas.	3,500,000	5	0.37½	1,312,500	0.30	1,050,000	4,462,500	Dec. '12	0.07½
Total					$56,971,791		$67,832,442	$742,613,543		

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES

NAME OF COMPANY AND SITUATION		SHARES Issued	Par Value	Per Share	DIVIDENDS PAID 1911 Total	1912 Per Share	1912 Total	To Date Total	Latest Date	Latest Amount
Amalgamated, c	Mont.	1,538,879	$100	$2.00	$3,077,757	4.00	6,155,517	72,043,153	Nov. '12	1.50
Am. Coal	Md.	50,000	25	1.50	75,000	1.50	75,000	2,797,187	Sept. '12	0.75
Am. Sm. & Ref., com	U.S.	500,000	100	4.00	2,000,000	4.66⅔	2,333,333	23,333,333	Dec. '12	1.00
Am. Sm. & Ref., pf	U.S.	500,000	100	7.00	3,500,000	8.16⅔	4,083,333	42,958,333	Dec. '12	1.75
Am. Smelters, pf. A	U.S.	170,000	100	6.00	1,020,000	6.50	1,105,000	7,110,000	Oct. '12	1.50
Am. Smelters, pf. B	U.S.	300,000	100	5.00	1,500,000	5.41⅔	1,625,000	10,857,000	Oct. '12	1.25
Butte Coalition, c	Mont.	1,000,000	15	1.00	1,000,000	.....	.....	4,700,000	Nov. '11	0.25
Cambria Steel	Penn.	900,000	50	2.50	2,250,000	2.50	2,250,000	16,210,000	Nov. '12	0.62½
Central C. & C., com	Mo.	51,250	100	6.00	307,500	6.00	307,500	3,636,250	Oct. '12	1.50
Central C. & C., pf	Mo.	18,750	100	5.00	93,748	5.00	93,748	1,737,807	Oct. '12	1.25
Consolidation Coal	Md.	190,247	100	6.00	1,143,554	6.00	1,196,592	20,832,042	Oct. '12	1.50
Crucible Steel, pf	Penn.	244,365	100	7.00	1,710,552	7.00	1,710,552	13,317,885	Oct. '12	1.75
Great Nor. Ore	Minn.	1,500,000	100	0.50	750,000	0.50	750,000	9,000,000	Dec. '12	0.50
Guggenheim Expl	U.S.	831,732	25	10.00	2,079,330	2.50	2,079,330	14,690,485	Oct. '12	0.62½
Harbison-Walker, com	U.S.	180,000	100	2.00	360,000	2.00	360,000	1,170,000	Dec. '12	0.50
Harbison-Walker, pf	U.S.	96,000	100	6.00	576,000	6.00	576,000	5,760,000	Dec. '12	1.50
Inter'l Nickel, com	U.S.	379,253	100	10.50	1,216,491	20.00	2,786,155	7,055,290	Dec. '12	2.00
Intern'l Nickel, pf	U.S.	86,661	100	6.00	534,756	6.00	519,966	3,739,436	Nov. '12	1.50
Intern'l Sm. & Ref	U.S.	100,000	100	8.00	800,000	8.00	800,000	2,700,000	Nov. '12	2.00
Island Creek Coal, pf	W.Va.	50,000	100	6.00	300,000	6.00	300,000	600,000	Oct. '12	1.50
Island Creek Coal, com	W.Va.	150,000	100	.....	.....	3.50	525,000	525,000	Aug. '12	3.50
Jeff. & Clrf. C. & I., pf	Penn.	15,000	100	5.00	75,000	5.00	75,000	1,162,000	Aug. '12	2.50
Lehigh Coal & Nav	Penn.	482,936	50	4.00	1,931,744	4.00	1,931,744	22,535,092	Nov. '12	1.50
National Carbon, pf	U.S.	55,000	100	7.00	315,000	7.00	315,000	4,321,250	Nov. '12	1.75
National Carbon, com	U.S.	45,000	100	6.00	330,000	6.00	330,000	2,186,250	Oct. '12	1.50
National Lead, com	N.Y.	206,554	100	3.00	619,656	3.00	619,656	7,176,564	Dec. '12	0.75
National Lead, pf	N.Y.	243,676	100	7.00	1,705,732	7.00	1,705,732	25,855,208	Dec. '12	1.75
Old Dominion, c	Ariz.	293,245	25	1.50	439,866	3.75	1,172,976	3,213,289	Oct. '10	1.25
Penn Salt	Penn.	60,000	50	3.00	180,000	3.00	180,000	15,638,000	Oct. '12	3.00
Penn Steel, pf	Penn.	165,000	100	7.00	1,155,000	6.00	990,000	12,541,000	Nov. '12	3.50
Phelps, Dodge & Co	U.S.	449,346	100	12.00	5,392,152	15.50	6,750,000	22,934,304	Dec. '12	5.50
Pittsburgh Coal, pf	Penn.	281,046	100	7.00	1,967,322	5.00	1,405,230	16,406,014	Oct. '12	1.25
Republic I. & S., pf	U.S.	204,169	100	7.00	1,429,184	5.25	1,071,888	12,517,704	Oct. '12	1.75
Sloss-Sheffield, com	Ala.	100,000	100	.....	.....	.....	.....	2,608,000	Dec. '10	1.25
Sloss-Sheffield, pf	Ala.	67,000	100	7.00	469,000	7.00	469,000	5,627,650	Oct. '12	1.75
Texas & Pacific Coal	Texas	25,000	100	6.00	150,000	6.00	300,000	2,270,030	Dec. '12	1.50
Uni. Metals Selling	U.S.	50,000	100	1.00	50,000	.....	.....	11,550,000	Jqn. '11	1.00
U. S. Red. & Ref	Colo.	99,646	100	.....	.....	.....	.....	1,360,294	Oct. '07	0.01
U. S. Steel Corp., com	U.S.	5,083,025	100	5.00	25,415,124	5.00	24,415,125	175,342,508	Dec. '12	1.25
U. S. Steel Corp., pf	U.S.	3,602,811	100	7.00	25,219,667	7.00	25,219,677	319,853,982	Nov. '12	1.75
U.S.Sm., Ref. & Min., com	U. S	351,073	50	2.00	702,208	2.25	789,984	4,518,866	Oct. '12	0.75
U.S.Sm., Ref. & Min., pf	U.S.	486,269	50	3.50	1,702,120	3.50	1,702,120	11,263,105	Oct. '12	0.87½
Vulcan Detinning, pfd	U.S.	15,000	100	5.50	82,500	7.00	105,000	787,500	Oct. '12	1.75
Warwick I. & S	U.S.	148,671	10	0.80	118,936	0.80	118,936	869,680	Nov. '12	0.40
Westmoreland Coal	Penn,	60,000	50	5.00	300,000	5.00	300,000	9,540,000	Oct. '12	2.50
Total		.....	.....	.....	$94,044,899	.....	$99,599,094	$1,042,711,491	.....	.....

FOREIGN MINING COMPANIES

Amparo, g.s	Mex.	2,000,000	$1	$0.12	$240,000	0.12	240,000	920,884	Nov. '12	0.03
Ajuchitlan, g.s	Mex.	50,000	5	1.00	50,000	1.00	50,000	212,500	Oct. '12	0.25
Batopilas, g.s	Mex.	446,496	20	.....	.....	.....	.....	(a)55,870	Dec. '07	0.01⅛
Beaver Con., s	Ont.	1,996,490	1	0.08½	169,790	0.09	179,967	349,890	Oct. '12	0.09
B. C. Copper, c	B.C.	591,709	5	0.25	147,928	0.30	177,512	526,442	Oct. '12	0.15
Buffalo, s	Ont.	1,000,000	1	0.44	440,000	0.27	270,000	1,587,000	Nov. '12	0.10
Butter's Salvador	C.A.	150,000	4.86	.....	.....	.....	.....	2,764,500	Dec. '12	0.17
City of Cobalt	Ont.	1,500,000	1	.....	.....	.....	.....	139,385	Apr. '09	0.03
Cobalt Central	Ont.	5,000,000	1	.....	.....	.....	.....	188,460	Aug. '09	0.01
Coniagas, s	Ont.	800,000	5	1.80	1,440,000	1.65	1,320,000	4,280,000	Nov. '12	0.45
Crown Reserve, s	Ont.	1,768,814	1	0.65	1,149,729	0.60	1,061,288	4,598,916	Dec. '12	0.05
Cobalt Townsite, s	Ont.	1,000,000	1	.....	.....	0.22	220,000	220,000	Nov. '12	0.01
Cananea Central, c	Mex.	600,000	10	.....	.....	0.60	360,000	360,000	Mar. '12	0.01
Canadian Goldfields, g	Can.	10,000,000	0.10	.....	.....	0.0015	15,000	15,000	Nov. '12	0.0015
Con. M. & S. of Can	Can.	58,052	100	.....	.....	4.00	232,176	1,014,061	Oct. '12	4.00
Crow's Nest Pass	B.C.	.....	.....	.....	124,216	.....	.....	2,182,864	Mar. '11	.....
Dolores, g.s	Mex.	400,000	5	0.22½	90,000	.....	.....	1,374,866	Jan. '11	0.22½
Dominion Coal, com	N.S.	150,000	100	2.00	300,000	4.00	600,000	5,250,000	Oct. '12	1.00
Dominion Coal, pf	N.S.	50,000	100	7.00	350,000	7.00	350,000	4,740,000	Aug. '12	3.50
Dos Estrellas, g.s	Mex.	300,000	0.50	2.50	750,000	7.50	2,250,000	13,005,000	Dec. '12	2.50
El Oro, g.s	Mex.	1,147,500	4.86	0.72	855,788	0.48	557,686	8,668,418	Dec. '12	0.24
El Rayo, g.s	Mex.	260,020	2	0.15	39,003	.....	.....	140,410	Apr. '11	0.15
Esperanza, s.g	Mex.	455,000	4.86	1.44	664,752	0.72	331,794	11,000,974	Dec. '12	0.36
Granby, s.l.c	B.C.	148,481	100	.....	.....	.....	.....	4,197,111	Dec. '10	1.00
Greene Cananea, c	Mex.	2,471,314	20	.....	.....	0.75	1,856,484	1,856,484	Nov. '12	0.25
Greene Con	Mex.	1,000,000	10	.....	.....	1.40	1,400,000	7,594,400	Nov. '12	0.40
Guanajuato D., pf., s	Mex.	10,000	1,000	3.00	30,000	.....	.....	274,356	Jan. '11	3.00
Hedley Gold	B.C.	120,000	10	2.50	300,000	3.00	360,000	864,000	Dec. '12	1.50
Hollinger, g	Ont.	2,750,000	1	.....	.....	0.09	247,500	247,500	Dec. '12	0.03
Kerr Lake, s	Ont.	600,000	5	1.65	990,000	1.00	600,000	4,320,000	Dec. '12	0.25
La Rose Con., s	Ont.	1,498,407	5	0.40	599,360	0.47½	711,847	3,139,179	Oct. '12	0.12½
Le Roi No. 2, g	B.C.	120,000	24.25	1.92	116,640	0.48	58,320	1,458,000	July '12	0.24
Lucky Tiger Com., g	Mex.	715,000	10	0.50	357,669	0.45	336,208	1,603,809	Dec. '12	0.07½
McK.-Dar. Sav., s	Ont.	2,247,692	1	0.40	899,075	0.40	899,769	2,832,089	Oct. '12	0.10
Mexican, l., pf	Mex.	12,500	100	3.50	43,750	3.50	43,750	1,018,750	May '12	3.50
Mines Co. of Am	Mex.	900,000	5	0.82½	742,500	0.15	135,000	877,500	Jan. '12	0.15
Montezuma, l., pf	Mex.	5,000	100	7.00	35,000	7.00	35,000	402,000	Nov. '12	7.00
N. Y. & Hond. Ros	C.A.	500,000	10	0.30	45,000	0.35	52,500	3,112,500	Dec. '12	p.20
Nipissing, s	Ont.	1,200,000	5	1.50	1,800,000	1.50	1,800,000	9,090,000	Oct. '12	0.37½
Nova Scotia, C. & S., com	N.S.	60,000	100	6.00	360,000	6.00	360,000	3,810,000	Oct. '12	1.50
Nova Scotia, C. & S., pf	N.S.	10,600	100	8.00	84,800	8.00	84,800	1,017,600	Oct. '12	2.00
Peñoles, s.l.g	Mex.	120,000	25	2.50	300,000	3.75	450,000	6,061,687	Dec. '12	1.25
Peregrina M. & M., pf	Mex.	10,000	100	.....	.....	.....	.....	328,656	Sept. '10	3.50
Pinguico, pf., s	Mex.	20,000	100	6.00	120,000	3.00	60,000	660,000	Apr. '12	3.00
Right of Way Mines, s	Ont.	1,685,500	1	0.04	67,420	.....	.....	202,260	Dec. '11	0.02
Rio Plata	Mex.	373,437	5	0.40	149,372	.....	.....	324,600	Dec. '11	0.1
San Rafael, g.s	Mex.	2,400	25	38.00	93,132	2.90	6,690	1,434,984	Oct. '12	0.90
Santa Gertrudis, g.s	Mex.	1,368,000	4.86	.....	.....	1.20	1,662,154	1,662,154	Dec. '12	0.48
San Toy	Mex.	6,000,000	1	0.05	360,000	0.01	60,000	420,000	Dec. '12	0.01
Sorpresa, g.s	Mex.	19,200	20	34.00	652,800	.....	.....	3,979,240	Jan. '11	34.00
Standard, s.l	B.C.	2,000,000	1	.....	.....	0.21¼	425,000	425,000	Dec. '12	0.02½
Temiskaming, s	Ont.	2,500,000	1	0.17	425,000	0.12	300,000	1,309,155	Oct. '12	0.03
Tem. & Hud. Bay, s	Ont.	7,761	1	18.00	139,698	24.00	186,564	1,706,520	Dec. '12	3.00
Tretheway, s	Ont.	1,000,000	1	0.20	200,000	0.20	200,000	861,998	Oct. '12	0.10
Wettlaufer-Lorrain, s	Ont.	1,416,590	1	0.15	212,489	0.20	283,318	495,767	Oct. '12	0.05
Total		.....	.....	.....	$15,934,911	.....	$21,130,597	$131,482,739	.....	.....

a Not including dividends of antecedent companies. *b* New series only. *c* Not including Superior & Pittsburgh dividends prior to consolidation.

Data of the World's Principal Mines

By S. F. Shaw*

Compiled from Annual Reports

Name of Mine.	Situation	Year	Tons	Profit	Dividends	Reserves Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
Abangarez	C.R.	1911	45,514	206,590	.....	340,200	.....	$21.84	$16.51
Abosso Gold	W.A.	'10-'11	68,746	£2,157	£20,000	213,997	.....	9.62	9.44
Ahmeek	U.S.	1911	598,549	870,272	100,000	.....	11,691	.....	.....
Alaska-Mexican	Alas.	1911	227,081	157,881	126,000	980,025	3,613	2.97	2.06
Alaska-Treadwell	Alas.	'10-'11	770,084	710,311	400,000	6,637,370	9,150	2.35	1.55
Alaska-United	Alas.	1911	449,071	126,415	81,090	2,835,184	8,754	2.33	1.82
Allouez	U. S.	1911	288,610	.....	.....	.....	.....	.....	2.20
Amalgamated Zinc	Aus.	'10-'11	319,256	£98,301	£75,000	.....	.....	.....	.....
Amparo	Mex.	1911	73,793	242,339	240,000	587,856	.....	9.66	5.77
American Smelters Sec	U.S.-Mex.	'10-'11	.....	5,092,083	2,520,000	.....	.....	.....	.....
Anaconda	U.S.	1911	4,319,995	.....	8,608,750	.....	.....	8.86	6.42
Anchor Tin	Tas.	'10-'11	102,944	.....	.....	.....	.....	.....	0.93
Arizona Copper	U.S.	'10-'11	744,746	£189,217	£214,518	.....	.....	5.66	.....
Ashanti Goldfields	W.A.	'10-'11	111,209	£144,565	£152,951	453,740	.....	18.71	12.38
Associated Gold Mines of West Australia	Aus.	'10-'11	105,238	—£5,846	.....	.....	.....	6.76	.....
Associated Northern Blocks	Aus.	'10-'11	18,158	£16,325	.....	.....	.....	.....	7.04
Aurora West	Tran.	1911	131,359	£28,959	.....	345,378	.....	5.89	4.77
Bantjes	Tran.	1911	273,212	£53,137	.....	896,087	.....	6.64	5.67
Baltic	U.S.	1911	696,785	530,215	500,000	.....	.....	2.52	2.08
Bibiana	W.A.	1911	67,565	£2,052	.....	397,759	.....	6.50	6.37
Bingham-New Haven	U.S.	1911	85,426	.....	288,689	.....	.....	9.82	.....
Blackwater	N.Z.	1911	44,038	£26,744	£37,498	70,979	5,768	10.81	7.02
Brakpan	Tran.	1911	241,204	£110,568	.....	1,925,346	10,675	6.67	2.23
Brilliant Extended	Aus.	½-1911	27,580	£10,002	£12,500	40,000	.....	10.45	8.84
British Broken Hill	Aus.	½-1911	63,370	£15,142	£26,400	.....	.....	7.53	6.43
		½-1911	81,777	£61,910	£45,000	.....	.....	.....	.....
British Columbia Copper	B.C.	1911	384,588	.....	147,931	.....	.....	.....	.....
Broken Hill Block 10	Aus.	½-1911	33,831	—£16,523	£10,000	.....	.....	6.41	.....
Broken Hill Block 14	Aus.	½-1911	11,604	.....	.....	.....	.....	11.86	5.36
Broken Hill North	Aus.	½-1911	128,270	£66,908	£52,500	1,500,000	.....	.....	8.79
		½-1911	128,691	£91,392	£61,250	2,000,000	.....	.....	.....
Broken Hill Proprietary	Aus.	'10-'11	52,441	£167,814	£48,000	.....	.....	.....	.....
Broken Hill South	Aus.	½-1911	175,044	£72,083	£60,000	.....	3,437	5.80	4.97
		½-1911	181,790	£144,423	£90,000	3,000,000	.....	8.65	4.85
		'10-'11	41,484	.....	370,000	.....	1,529	.....	10.09
Buffalo Mines	Ont.	'10-'11	483,290	870,986	1,062,750	.....	.....	7.50	5.53
Bunker Hill & Sullivan	U.S.	1911	36,929	£15,126	.....	.....	.....	23.86	20.32
Burma Mines	Burma	1911	.....	2,572,241	2,150,000	.....	26,195	.....	.....
Calumet & Arizona	U.S.	1911	.....	.....	2,400,000	.....	.....	.....	1.92
Calumet & Hecla	U.S.	'10-'11	79,186	£267,689	£220,000	38,415	.....	22.16	9.39
Camp Bird	U.S.	1911	741,873	.....	.....	.....	51,784	.....	5.28
Cananea Con	Mex.	'10-'11	82,925	£60,862	£43,125	180,000	.....	.....	.....
Cape Copper	Cape Col.	½-1911	38,253	—£1,936	.....	.....	.....	.....	5.46
Carn Brea	Eng.	½-1911	41,670	£5,297	.....	.....	.....	6.05	5.43
Centennial-Eureka	U.S.	1911	108,275	.....	300,000	.....	.....	.....	.....
Champion	U.S.	1911	347,885	60,371	500,000	.....	.....	.....	.....
Champion Reef	India	'10-'11	205,169	£133,808	£112,666	365,296	.....	11.04	7.92
Chillagoe	Aus.	'10-'11	60,943	£21,000	.....	.....	.....	.....	.....
Chino Copper	U.S	.....	.....	.....	.....	54,980,646	.....	.....	.....
Cinderella Deep	Tran.	1911	192,341	.....	.....	740,157	13,396	6.69	5.88
City Deep	Tran.	1911	349,913	£90,935	.....	2,078,805	.....	.....	.....
City and Suburban	Tran.	1911	316,679	£162,523	£153,000	789,084	.....	7.25	4.76
Coniagas	Ont.	'10-'11	52,489	.....	1,440,000	.....	.....	.....	.....
Consolidated Main Reef	Tran.	'10-'11	252,485	£87,974	80,881	516,890	22,452	6.92	5.22
Con. Mining & Smelting	B.C.	'10-'11	388,785	202,278	.....	.....	.....	11.42	.....
Con. Mercur	U.S.	'10-'11	239,190	496	.....	.....	5,558	2.32	2.32
Copper Queen	U.S.	1911	619,182	4,155,011	5,200,000	.....	62,150	.....	.....
Corocoro United Copper	Bol.	'10-'11	47,481	£3,646	.....	.....	.....	.....	.....
Crown Mines L't'd	Tran.	1911	1,618,500	£1,271,106	£1,034,110	10,124,072	.....	8.50	4.70
Daly-Judge	U.S.	1911	59,461	.....	180,000	.....	.....	.....	.....
Daly West	U.S.	1911	88,141	278,259	162,000	.....	1,873	9.28	.....
Detroit Copper	U.S.	1911	517,087	930,496	800,000	.....	.....	.....	.....
Dolcoath	Eng.	½-1911	40,315	£36,370	£34,000	.....	.....	.....	7.67
		½-1911	46,343	£31,243	£34,450	.....	2,070	10.49	7.21
Dos Estrellas	Mex.	1911	475,548	5,882,774	750,000	1,870,637	.....	11.85	5.75
Ducktown Sulphur & Copper	U.S.	1911	145,688	£25,958	£25,954	.....	.....	.....	.....
Durban-Roodepoort	Tran.	1911	165,662	£3,803	£50,000	661,791	.....	5.98	5.87
Durban-Roodepoort Deep	Tran.	1911	262,540	£60,834	£22,000	1,288,071	14,938	7.04	5.91
East Butte	U.S.	'10-'11	85,876	268,651	.....	.....	.....	.....	.....
East Rand Proprietary	Tran.	1911	2,194,552	£858,801	.....	6,716,605	.....	6.15	4.26
Eldorado Banket	Rhod.	'10-'11	82,802	£92,742	£90,000	179,343	3,003	12.05	6.61
El Oro	Mex	'10-'11	360,294	.....	£172,125	484,139	.....	7.63	3.90
Esperanza	Mex.	1911	250,022	.....	220,487	.....	1,467	6.17	4.43
Federal	U.S.	'10-'11	759,108	1,241,115	839,027	863,340	.....	7.03	5.88
Ferreira	Tran.	1911	310,300	£175,322	£190,000	324,603	.....	6.78	.....
Ferreira Deep	Tran.	'10-'11	373,196	£327,732	£409,500	1,837,808	.....	10.59	5.94
Florence Goldfield	U.S.	1911	48,874	— 42,008	105,000	.....	',699	5.17	6.09
Franklin Furnace	U.S.	1910	375,677	.....	.....	.....	.....	.....	.....
Frontino & Bolivia	Colom.	½-1911	17,147	—£4,518	.....	24,166	.....	7.91	9.19
Gaika Gold	Rhod.	'10-'11	29,550	£11,777	£13,024	30,000	.....	8.34	6.52
Geduld Proprietary	Tran.	1911	138,700	—£4,958	.....	607,300	.....	6.50	6.60
Geldenhuis	Tran.	1911	801,860	£209,456	£175,725	2,262,840	.....	6.74	5.47
Giant	Rhod.	'10-'11	123,789	£97,860	£49,360	308,146	.....	7.94	4.10
Ginsburg	Tran.	1911	138,459	£56,901	£52,500	367,646	.....	7.07	5.07
Globe & Phoenix	Rhod.	1911	71,802	£321,293	£320,000	173,613	.....	32.80	11.05
Glynn's Lyndenburg	Tran.	'10-'11	33,870	£44,022	£42,500	73,280	.....	12.63	6.13
Golden Horseshoe	Aus.	1911	269,667	£22,715	.....	804,269	.....	7.27	6.84
Goldfield Con	U.S.	'10-'11	330,549	7,526,846	7,118,296	600,000	46,739	32.55	8.52
Glencair	Tran.	1911	227,753	£27,485	£27,500	925,000	.....	3.86	3.28
Great Boulder Perseverance	Aus.	1911	243,109	£48,458	.....	807,664	.....	6.17	4.84
Great Boulder Proprietary	Aus.	1911	187,510	£262,974	£262,500	698,662	.....	14.11	7.90
Great Cobar	N.S.W.	'10-'11	475,988	.....	.....	3,088,000	.....	.....	.....
Great Fingall	Aus.	1911	101,949	£15,816	£12,500	84,738	.....	.....	.....
Great Fitzroy	Aus.	'10-'11	69,791	£9,836	.....	590,522	.....	.....	10.26
Greene-Cananea	Mex.	1911	.....	1,307,131	.....	.....	.....	9.56	.....
Grenville	Eng.	1911	17,059	£6,956	.....	.....	.....	.....	6.65
Gwalia Con	Aus.	'10-'11	.....	£10,712	.....	.....	.....	.....	.....

Note—Abbreviations used in above table: Alas, Alaska; Aus., Australia; Bol., Bolivia; Braz., Brazil; B. C., British Columbia; Eng., British Isles (Cornwall); Colom., Columbia; C. R., Costa Rica; Hon., Honduras; Ind., India; Malay, Malay States; Mex., Mexico; N. S. W., New South Wales; N. Z., New Zealand; Ont., Ontario; Port., Portugal; Rhod., Rhodesia; Sib., Siberia; S. A., South Africa; Tas., Tasmania; Tran., Transvaal; U. S., United States; W A., West Africa.
— Loss for the year. *Cubic yards. All profits and dividends are in dollars except where otherwise noted.

*Superintendent, Charcas Unit, National Metallurgical Co., Charcas, S. L. P., Mex.

DATA OF THE WORLD'S PRINCIPAL MINES—(Continued).

Name of Mine.	Situation	Year	Tons	Profit	Dividends	Reserves Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
Hainault	Aus.	'10-'11	62,332	£4,607	£3,750	100,000	.....	6.57	6.21
Hecla	U.S.	1911	136,479	287,103	240,000	.....	.....	7.34	5.23
Hedley Gold	B.C.	1911	57,815	318,152	300,000	.....	',315	11.27	.....
Hercules	U.S.	'10-'11	25,765	.....	418,542	.....	.....	48.48	.....
Homestake	U.S.	'10-'11	1,468,263	.....	1,310,400	.....	.....	4.12	2.69
		1911	888,057	.....	764,400	.....	.....	3.58	2.53
Independence	U.S.	'10-'11	109,800	£21,000	£12,500	.....	9,186	20.68	.....
Iron Silver	U.S.	1911	42,673	187,600	100,000	.....	.....	10.04	.....
Isle Royale	U.S.	1911	457,440	156,708	.....	.....	.....	2.12	1.67
Ivanhoe	Aus.	1911	238,965	£218,221	£220,000	1,088,421	.....	9.80	5.38
Jumbo Gold	Rhod.	'10-'11	40,490	.....	.....	30,083	.....	8.06	8.48
Jumper's	Tran.	'10-'11	120,802	£43,865	£40,000	122,314	.....	9.01	7.25
Jupiter	Tran.	1911	314,650	£26.938	.....	1,089,000	.....	5.52	5.12
Kalgurli	Aus.	'10-'11	127,010	£116,326	£136,500	.....	.....	11.72	7.01
Kerr Lake	Ont.	'10-'11	1,810	937,379	1,200,000	.....	7,856	.....	162.46
Komata Reefs	N.Z.	1911	7,582	£817	.....	.....	.....	11.15	10.62
Knight's Central	Tran.	1911	315,171	.....	.....	644,300	.....	.....	.....
Knight's Deep	Tran.	'10-'11	695,670	£252,833	£225,234	1,650,000	.....	4.76	2.99
La Blanca	Mex.	'10-'11	67,354	.....	.....	.....	.....	.....	.....
Lancaster West	Tran.	1911	258,682	£33,220	.....	.....	.....	5.51	4.88
Lang aagte Estate	Tran.	1911	625,187	.....	£130,425	1,281,307	.....	5.73	4.36
La Rose	Ont.	1911	.....	.....	500,450	.....	.....	.....	.....
Le Roi No. 2	B.C.	'10-'11	44,619	£30,176	£36,000	.....	.....	9.24	6.68
Lena Goldfields	Sib.	'10-'11	.....	£333,643	£336,664	.....	.....	.....	.....
Lucky Tiger	Mex.	1911	46,945	328,846	357,601	218,315	4,099	27.75	14.37
Luipardslei	Tran.	.....	.....	.....	.....	398,000	.....	.....	.....
Main Reef West	Tran.	'10-'11	196,391	£139,873	£101,250	628,260	13,739	8.38	4.92
Mason & Barry	Port.	1911	412,023	£59,892	£55,551	.....	.....	.....	.....
McKinley-Darragh-Savage	Ont.	1911	60,414	.....	899,075	126,410	7,944	7.99	.....
Mexico Mines of El Oro	Mex.	'10-'11	136,400	.....	£144,000	318,720	12,139	11.20	.....
Meyer & Charlton	Tran.	1911	117,154	£72,092	£80,000	347,040	.....	8.73	5.74
Miami	U.S.	1911	450,036	.....	.....	18,232,000	.....	4.50	3.75
Moctezuma	Mex.	1911	517,352	1,206,183	754,000	302,000	13,668	8.07	5.04
Mohawk	U.S.	1911	802,548	.....	175,000	.....	15,458	.....	1.57
Montana-Tonopah	U.S.	'10-'11	52,092	172,602	120,000	.....	.....	.....	.....
Morning	U.S.	1911	384,600	114,721	.....	.....	.....	4.62	4.32
Mt. Bischoff Tin	Tas.	½-1911	101,310	£21,179	£22,500	.....	.....	.....	.....
		½-1911	103,412	£40,019	£30,000	.....	.....	.....	1.42
Mt. Boppy	N.S.W.	1911	74,132	£23,668	£24,200	.....	.....	7.29	5.90
Mt. Elliott	Aus.	'10-'11	42,616	£130,907	£73,759	215,000	.....	.....	29.72
Mt. Lyell	Tas.	½-1911	160,965	£69,033	.....	3,519,670	.....	.....	4.87
Mt. Morgan	Aus.	'10-'11	354,137	£136,563	£200,000	3,613,500	3,796	13.08	11.21
Mysore	Ind.	1911	291,477	£424,274	£366,600	1,300,369	31,766	14.95	7.47
Namaqua Copper	Cape Col.	1911	35,506	£53,319	£47,165	104,677	.....	.....	.....
Natomas Con	U.S.	'10-'11	44,542,141*	2,535,537	.....	298,453,395	.....	.....	.....
Nevada Con	U.S.	1911	3,338,242	.....	2,957,958	40,853,371	.....	3.13	2.30
New Goch	Tran.	1911	346,862	£115,532	£68,750	894,632	.....	5.85	4.22
New Heriot	Tran.	1911	144,431	£102,170	£92,000	569,716	.....	8.38	4.96
New Kleinfontein	Tran.	1911	451,145	£205,965	£169,750	1,607,015	.....	7.25	4.04
New Modderfontein	Tran.	'10-'11	538,400	£294,010	£297,500	3,452,195	.....	7.15	.....
New Primrose	Tran.	1911	281,648	£217,658	£227,500	423,311	.....	7.27	3.51
New Unified	Tran.	1911	122,465	.....	.....	288,343	.....	7.50	5.98
New York & Honduras-Rosario	Hond.	'10-'11	35,813	.....	45,000	97,365	13,050	24.00	.....
New Reitfontein	Tran.	1911	180,822	£39,349	£30,504	361,484	.....	6.27	5.22
Nigel	Tran.	1911	134,450	£48,268	£33,465	190,572	.....	7.50	5.98
Nipissing	Ont.	1911	.....	2,095,241	1,800,000	.....	.....	.....	.....
North Butte	U.S.	1911	410,694	641,858	492,000	710,920	17,700	9.13	7.57
North Star	U.S.	1911	95,401	419,528	425,000	.....	.....	10.75	5.86
Nourse	Tran.	'10-'11	643,675	£220,319	£165,564	2,050,705	28,549	.....	5.40
Nundydroog	Ind.	1911	102,873	£140,573	127,350	160,599	12,096	.....	9.38
Old Dominion	U.S.	1911	.....	621,964	486,000	.....	10,447	.....	.....
Ooregum	Ind.	1911	152,545	£138,862	£120,231	186,576	.....	11.40	6.98
Oriental Con	Chosen	'10-'11	342,956	672,720	644,085	802,280	23,037	4.70	2.53
Oroville Dredging	U.S.	1911	4,443,262	200,454	.....	.....	.....	0.106	0.059
Ouro Preto	Braz.	'10-'11	69,680	£4,964	£6,163	170,834	.....	6.90	6.57
Osceola	U.S.	1911	1,246,596	664,628	673,050	.....	.....	1.88	1.37
Otavi	W.A.	'10-'11	42,000	.....	£224,500	.....	.....	.....	5.59
Pahang Con	Malay	'10-'11	78,448	£21,232	.....	.....	.....	.....	.....
Penhalonga	Rhod.	'10-'11	49,900	£966	.....	.....	.....	5.28	5.19
Poderosa	Chile	1911	13,392	—£16,995	.....	21,000	.....	40.90	45.58
Portland	U.S.	'10-'11	67,515	307,380	240,000	.....	.....	18.32	14.62
Princess Estate	Tran.	1911	166,628	£24,215	£28,751	656,500	.....	7.25	6.55
Progress	N.Z.	1911	41,596	.....	.....	.....	5,017	5.61	9.12
Prestea Block A	W.A.	1911	93,483	£2,701	.....	975,101	.....	8.56	8.19
Quicksilver Mining	U.S.	'10-'11	24,976	22,182	.....	.....	.....	.....	4.99
Quincy	U.S.	1911	1,382,524	507,597	440,000	.....	.....	2.07	1.72
Randfontein Central	Tran.	1911	2,159,033	£854,241	.....	5,658,859	87,541	5.99	4.07
Ray Con	U.S.	1911	681,519	147,545	.....	77,314,470	.....	.....	2.66
Rio Plata	Mex.	'10-'11	8,775	.....	149,554	.....	.....	.....	.....
Rio Tinto	Spain	1911	2,185,605	.....	£1,065,625	.....	.....	3.01	.....
Robinson	Tran.	1911	592,700	£826,898	£756,250	2,528,794	.....	11.23	4.25
Robinson Deep	Tran.	'10-'11	533,850	£334,379	.....	1,140,000	.....	7.63	4.59
Roodepoort United	Tran.	1911	366,490	£73,469	.....	448,000	.....	5.27	4.29
Rooiberg Minerals	Tran.	'10-'11	17,781	£52,674	£13,500	21,650	.....	.....	.....
Rose Deep	Tran.	1911	693,250	£319,066	£280,000	729,012	.....	6.77	4.57
Salisbury	Tran.	'10-'11	93,396	£15,306	£13,500	82,896	.....	4.41	3.61
San Rafael y Anexas	Mex.	½-1911	71,587	273,057	217,200	.....	.....	11.52	.....
Santa Gertrudis	Mex.	1911	.....	.....	.....	630,000	.....	.....	.....
San Toy	Mex.	1911	.....	.....	300,000	.....	.....	.....	.....
Selukwe Columbia	Rhod.	'10-'11	31,535	£14,965	£12,500	40,000	.....	9.90	7.94
Seoul Mining	Chosen	1911	70,229	263,297	200,000	211,400	.....	7.85	3.75
Shannon	U.S.	'10-'11	263,975	.....	.....	1,000,000	.....	.....	.....
Shattuck-Arizona	U.S.	'10-'11	32,029	396,687	.....	.....	9,278	.....	.....
Sheba Gold	Tran.	'10-'11	49,455	£20,573	£13,486	104,250	.....	9.42	7.75
Simmer & Jack	Tran.	'10-'11	811,448	£526,866	£600,000	2,520,000	.....	6.32	3.11
Simmer Deep	Tran.	1911	539,981	£56,784	.....	1,312,000	16,219	4.55	4.05
Snowstorm	U.S.	'10-'11	34,463	25,691	44,985	.....	.....	4.97	4.23
Sons of Gwalia	Aus.	1911	165,644	.....	£81,250	.....	.....	8.80	6.42
South Crofty	Eng.	1911	63,882	£31,981	£17,500	.....	.....	.....	5.24
South Kalgurli	Aus.	'10-'11	112,170	£20,465	£20,000	173,200	.....	.....	5.35
Spassky Copper	Sib.	'10-'11	31,302	£81,846	£77,000	100,000	.....	34.80	.....
Standard Con	U.S.	'11-'12	8,798	.....	.....	.....	6,254	.....	17.11
St. John Del Rey	Braz.	'10-'11	189,600	.....	£60,078	1,158,560	.....	10.77	7.12
Sulphide Corporation	Aus.	'10-'11	226,768	£179,448	£144,375	.....	.....	20.84	17.65
Superior	U.S.	1911	162,599	—51,989	.....	.....	.....	2.65	2.97
Talisman Con	N.Z.	'10-'11	45,850	£110,307	£100,447	.....	.....	22.36	10.38
Taquah Mining & Exp	W.A.	'10-'11	12,387	.....	.....	95,799	.....	.....	.....
Tasmania Gold	Tas.	'10-'11	53,968	—£4,020	.....	43,084	.....	8.88	9.16
Temiskaming	Ont.	'10-'11	11,785	288,972	181,507	.....	9,244	.....	.....
Tennessee	U.S.	1911	436,285	407,049	300,000	.....	3,896	.....	.....
Tharsis Sulphur	Spain	1911	327,348	£188,139	£187,500	.....	.....	.....	.....
Tilt Cove	Newf.	'10-'11	29,077	£4.733	.....	40,000	.....	.....	.....
Tomboy	U.S.	'10-'11	116,222	272,267	£60,000	427,000	.....	6.61	4.37
Tonopah-Belmont	U.S.	1911	115,563	.....	1,500,000	348,912	.....	29.14	.....

DATA OF THE WORLD'S PRINCIPAL MINES—(Continued).

Name of Mine.	Situation	Year	Tons	Profits	Dividends	Reserves Tons	Development Feet	Price Rec'd per Ton	Cost per Ton
Tonopah Mining	U. S.	'11-'12	174,685	.....	1,600,000	304,824	.....	18.08	.....
Treasury Gold	Tran.	'10-'11	64,230	£16,482	.....	250,000	.....	6.31	5.06
Trethewey	Ont.	1911	.....	160,318	200,000	.....	.....	.....	.....
Tri-Mountain	U.S.	1911	734,392	454,589	500,000	.....	.....	2.66	2.05
Troitzk Goldfield	Sib.	'10-'11	40,628	—£8,945	.....	.....	.....	5.13	6.20
Tronoh	Malay P.	1911	461,025*	£185,548	£136,000	.....	.....	4.61	.....
Tuolumne	U.S.	1911	30,499	.....	360,000	.....	.....	15.50	.....
U. S. S. R. & M. Co.	U.S.-Mex.	1911	1,037,685	.....	2,404,328	.....	.....	.....	.....
Utah Con.	U.S.	1911	.....	438,439	150,000	263,436	.....	.....	.....
Utah Copper	U.S.	1911	4,680,801	4,470,933	4,703,022	229,830,000	42,434	2.74	1.78
Van Roi	B.C.	1911	22,427	—£2,661	.....	.....	.....	.....	.....
Van Ryn	Tran.	'10-'11	396,950	£210,847	£225,000	1,655,910	.....	6.94	4.36
Village Main Reef	Tran.	1911	474,135	£404,196	£330,400	1,814,754	5,233	9.07	4.97
Vindicator	U.S.	1911	30,233	238,804	135,000	.....	7,210	27.47	15.47
Vogelstruis Estate	Tran.	'10-'11	101,033	—£18,074	.....	147,815	.....	6.38	7.62
Waihi	N.Z.	1911	350,699	£332,857	£272,748	1,534,826	.....	9.41	4.80
Waihi Grand Jc.	N.Z.	1911	105,956	£25,949	£19,218	198,350	.....	6.99	5.80
West End Con.	U.S.	'10-'11	16,164	42,490	.....	.....	.....	20.91	18.29
Wanderer	Rhod.	'10-'11	195,234	£15,190	.....	424,195	6,329	2.40	2.22
West Rand Con.	Tran.	1911	319,640	.....	.....	1,003,000	.....	.....	.....
Wheal Kitty	Eng.	1911	7,816	.....	.....	.....	.....	.....	6.98
Witwatersrand	Tran.	1911	416,741	£151,299	£148,750	1,225,082	.....	5.14	3.40
Witwatersrand Deep	Tran.	1911	500,330	£301,542	£192,500	1,436,202	.....	7.12	4.19
Wolverine	U S.	'10-'11	.....	485,705	600,000	.....	.....	.....	.....
Wolhuter	Tran.	'10-'11	344,015	£164,269	£129,000	808,780	.....	6.45	4.13
Worchester Exploration	Tran.	1911	60,286	£14,616	£19,144	93,000	.....	5.61	4.44
Yukon Gold	Alas.	1911	6,276,800*	.....	1,312,500	.....	.....	0.495	.....
Zinc Corporation	Aus.	.....	140,370 Tailings	.....	.....	.....	.....	.....	.....
		½-1911	64,313 Ore	£73,243	.....	.....	.....	.....	.....

The accompanying tabulation of data obtained from annual reports and abstracts of annual mining reports published in the principal mining magazines, was compiled for the purpose of securing relative data on the costs of production of the various metal-mining companies operating in different parts of the world.

These data cover for the most part the calendar and fiscal years ending in 1911. Since the reports of many mining companies for the year 1912 will not be published before June, 1913, it is not possible to cover the year 1912 at this date.

The column headed " tonnage produced" refers to the tons of ore actually shipped to the smeltery or treated locally and does not include waste which was sorted out of the ore hoisted. It is customary among the Rand mines to note the amount of waste so hoisted and sorted out, but this applies to but few American mines. Some English companies use the long ton of 2240 lb., but as no distinction is made between the long and short ton in many of the abstracts published, there has been no attempt to distinguish between same in this table. However, it is generally probable that the Australian companies are speaking of long tons, the American of short, while the others may use either.

Where sufficient data were given to enable it to be done, the profits are figured as the amount remaining after all expenses of operation, administration, depreciation, development, taxes, etc., were paid. Such money as was put into the capital account, however, is not included.

In figuring the cost per ton, all items in the nature of expenses of operation, administration, depreciation, etc., are included exactly as in the case of computing the profits.

The reserves are, of course, those given in the official report as the number of tons of ore remaining blocked out at the end of the year under review. Probable ore is not so included, neither is that portion of the vein which, though blocked out, is too low grade to return a profit.

I have compiled this table for several years for my own use, publishing it for the first time in the JOURNAL of Jan. 13, 1912, and in the future expect to publish it annually, and if the various mining companies will send me a copy of their reports a greater degree of accuracy will be insured. It will be seen that English companies form a large percentage of those enumerated, as there is a greater tendency for these companies to make public the items of production, cost, ore reserves, etc., than is the case with American companies.

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Antimony in 1912

The antimony situation in the United States remains unchanged. Several carloads of ore were mined in Utah, and successfully treated to recover the antimony contents, but even at the present price of the metal, the mines are burdened with too expensive transportation to be profitable, and they have suspended production. As there was but one producer, figures cannot, of course, be given.

The great bulk of the antimony used in the United States must therefore be imported, under a duty of 1½c.

AVERAGE PRICES OF ANTIMONY

(In Cents per Pound)

	1910			1911			1912		
	Cookson's	U. S.	Ordinaries	Cookson's	U. S.	Ordinaries	Cookson's	U. S.	Ordinaries
January	8.500	7.988	7.738	8.25	7.74	7.45	7.53	7.47	6.88
February	8.469	7.969	7.578	8.38	8.02	7.65	7.27	7.44	6.83
March	8.359	7.938	7.313	9.56	9.13	9.00	7.65	7.56	6.86
April	8.438	7.938	7.438	9.54	9.13	8.52	8.05	7.75	6.94
May	8.438	7.938	7.438	9.50	8.97	7.99	8.02	7.75	7.10
June	8.241	7.938	7.438	8.75	....	7.42	8.09	7.78	7.21
July	8.175	7.938	7.400	8.50	....	7.35	8.42	7.96	7.50
August	8.278	7.938	7.328	8.44	7.94	7.36	8.59	7.98	7.70
September	8.313	7.938	7.313	8.31	7.84	7.26	9.12	8.50	8.26
October	8.263	7.900	7.400	8.14	7.71	6.96	10.30	9.62	9.30
November	7.922	7.656	7.188	7.97	7.61	6.92	10.39	9.86	9.30
December	7.625	7.438	7.063	7.78	7.50	6.82	10.21	9.62	9.18
Year	8.252	7.876	7.386	8.59	8.16	7.54	8.90	8.26	7.76

The imports for the first 10 months of 1912 were 8,848,874 lb. of metal contents in all forms, an increase of 355,370 lb. over 1911.

The American Smelting & Refining Co., the Balbach Smelting & Refining Co., International Lead Co., and United States Metals Refining Co., produced antimonial lead (for statistics see under "Lead"), and there is a small production of secondary metal by junk dealers.

ANTIMONY OXIDE

Antimony oxide opened the year at 7¼@7½c. per lb., but under stimulus of a good demand, and rising prices for metal and labor, the price gradually advanced, closing at 9¼@10½c. The material was practically all manufactured from Chinese needle antimony.

Arsenic in 1912

Arsenic opened at about 1⅞@2c. per lb. in 1912, with both producers and dealers discouraged. The Anaconda arsenic plant was understood to be closed down, and the American Smelting & Refining Co., and the United States Smelting Co. to be producing at the lowest possible rate. However, the situation appeared worse than it was, much of the apparent oversupply being due to the liquidation of great speculative stocks, which were finally unloaded at any price obtainable, while actual production had been passed by consumption.

By the end of February, white arsenic was already 2⅝@2⅞c. per lb., and spot goods were scarce. The market continued climbing in July, until September, when the same speculative group which had unloaded on the ground floor was said again to have come in the market at 4¾c., with the result that prices went up ¼ to ½c. higher. Prices declined a little, the year closing at about 4⅞c., with some further decline in sight, though supply and demand were nearly balanced.

The United States producers are as given above, although some of the large acid makers are said to be marketing some arsenious sulphide recovered from the preparation of arsenic-free sulphuric acid. Peñoles is the only producer in Mexico, while the Canadian Copper Co. has announced its withdrawal from arsenic manufacture, leaving the Deloro Mining & Reduction Co., Deloro, Ont., and the Coniagas Reduction Co., at St. Catherines, Ont., the only Canadian makers.

According to information furnished by the producers, December partly estimated, the total United States production in 1912 was 2926 tons, against 3081 tons in 1911, and 1526 tons in 1910.

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Increased Sulphur Output

The sulphur industry in 1912 was marked by new activties in various parts of the world, especially in exploration.

In the United States, the Union Sulphur Co. not only maintained its dominant position in this field but produced in 1912 more sulphur than the entire world consumed. This greatly increased production from the Louisiana mine was for the purpose of putting the company in a position to handle a world-wide trade by accumulating sufficient stocks as a guarantee against deliveries. Important extensions were made by the company in its European facilities, including a 25-year lease from the city of Rotterdam of a tract of land, 330x420 ft., with dock facilities. A new refinery and grinding and storage facilities are under construction. The company also acquired in 1912 storage facilities at Harburg, in Germany. Besides these new European distributing centers, the company already had refineries and storage plants at Marseilles and Cette in France. All of these plants will be supplied by the company's own fleet of ships, to which two were added in 1912. The stocks of sulphur at Sulphur Mine, La., were unusually large at the end of the year.

A new operation, using the hot-water process, was undertaken by the Freeport Sulphur Co. near the mouth of the Brazos River in Texas. This company, backed by important capital, completed a plant for the operation of the sulphur deposits underlying Bryan Heights, and late in November a demonstration run was made in which some sulphur was pumped, the exact figures not being available. The plant was then shut down for various adjustments. "Steaming" was to be resumed early in 1913. The productive ability of this operation will be determined during the coming year.

Prices in the United States were steady throughout 1912, quotations being $22 per ton at New York and $22.50 at by-ports. No Sicilian crude was imported in 1912, although a few thousand tons of refined sulphur came from that source, and probably about the normal amount was imported from Japan at Pacific ports. There was a good demand for sulphur in Europe; as the estimated output of the Consorzio was only about 370,000 tons and shipments increased to 470,000 tons, the Sicilian stocks were reduced by approximately 100,000. Two or three of the Sicilian mines with a normal output of 40,000 tons were closed most of the year by reason of persistent fires and other causes, and it would appear that sulphur bids fair to have a good market in 1913 with a somewhat restricted production.

A little sulphur was produced in Mexico by the German lessees as heretofore; operations of local importance were conducted in a number of countries, and in some of the Western states of the United States.

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Pyrites Importations Declined

A quiet year was experienced by the importers of pyrites in 1912, though the domestic mines operated practically at capacity. The domestic mines, however, supply only about 300,000 tons, or less than 25% of the normal consumption of the United States. The importations are therefore the controlling factor in the pyrites market. In a normal year the imports of Spanish and Portugese pyrites amount to about 1,000,000 long tons, but due to over-extension of the phosphate industry in 1911, the 1912 demand was light. Not only did the normal increase fail to materialize, but the importations fell short of the usual amount by probably 20%; it therefore appears that the imports in 1912 did not much exceed 800,000 tons, and may not have reached that figure. Prices fluctuate but little, with 13@13½c. per unit quoted for furnace-size ore, and 12c. for fines.

The states supplying the most of the domestic pyrites were, in the order of their importance: Virginia, New York and California, with smaller productions from Illinois, Wisconsin, Ohio, Alabama and Georgia. Two-thirds of the domestic output was produced by three companies, the Arminius and the Sulphur Mines, in Virginia, and the St. Lawrence Pyrites Co., at DeKalb Junction, New York. Domestic prices ranged from 8@10c. per unit, and probably averaged 9¼c. f.o.b. mines.

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Fluorspar in 1912

The demand for fluorspar of all grades has been stronger in 1912 than for several years past, and bids fair to continue for some time. The prices may be quoted at about $15 for Keystone ground in bulk (for acid manufacture), $11.50 for A-1, $7 for lump, and $6.25 for gravel, all f.o.b. mines. The Rosiclare and Fairview companies in Illinois produced about 104,000 tons in 1912. Colorado, Kentucky and New Mexico are also supposed to have made small productions, which, judging from 1911 outputs, will probably aggregate 13,000 tons.

The Metallurgy of Lead in 1912

By H. O. Hofman*

In 1912 no decided change occurred in methods of treating lead ores or desilverizing lead bullion. A new lead smeltery went into blast at Tooele, Utah, and a Parkes desilverizing plant to treat the lead bullion produced was erected near Chicago. The International Congress of Applied Chemistry held in Washington and New York brought to light interesting information of historical, scientific and practical nature. Advance in the metallurgy of lead lay mainly along the lines of research, which gives precision to the details of present and future practice; the study of properties of lead and its compounds, and of blast roasting, received the larger share.

New Plants

The lead-smelting department of the International Smelting & Refining Co., Tooele, Utah (Eng. and Min. Journ., Vol. 94; p. 2), has in operation two blast furnaces of usual construction, fed mechanically from the top. A new feature is the preparation of the charge. The usual practice at lead smelteries of bedding the various ores was replaced by the methods in use at some blast-furnace plants treating sulphide copper, e.g., that of Anaconda. There are 56 suspended bins placed in two rows delivering into 26 hoppers in one row, each of which is provided with scales. In making up a charge, be it for the sintering or for the smelting division, a train of cars passes beneath the hoppers and receives weighed amounts of ore, flux and fuel. Thus the handling of materials is greatly simplified and cheapened. In fact, the absence of the usual large crew of day laborers is noticeable. The plant has four 100-ton Dwight-Lloyd blast-roasting machines, in which the making up of the charges has also been greatly simplified by the use of storage hoppers and belt conveyors.

The lead-bullion refinery of the International Smelting & Refining Co., at Chicago, was sufficiently completed in October to start operations but details have so far not been made generally known.

Blast Furnace Work

A paper of historical interest by R. C. Canby (VIII Int. Cong. App. Chem., 1912, Vol. III, pp. 1-22) traces the development of the American blast furnace from its early beginnings at Eureka, Nev., in 1870, to the present day. The brick-smelting zone began to be replaced by water-jackets in 1872; the furnaces, 36x60in., at the tuyeres were enlarged in the early eighties to 42x120 in. and are at present 44x144 in. The treatment of sulphide ore was the cause of the introduction of simple hand-roasting furnaces, which were followed by mechanical roasters, and these have at present been replaced almost wholly by blast-roasting devices. The settling arrangements for matte had to be enlarged and perfected; in several places settling reverberatory furnaces are in use so long as the amounts of zinc and arsenic in the products are not excessive. By the substitution of blast-roasted material for fine ore and roasted sulphides, the smelting power of a furnace has been increased one-third, the amount of fuel required and of flue dust made have been greatly reduced. With all these improvements has come a reduction in the cost of smelting, which is now, in Colorado, about $2.25 per ton of charge.

Filtration of fume and dust produced by lead blast furnaces has become almost universal in American practice. Most valuable data upon this subject were made public by A. Eilers (VIII Int. Cong. App. Chem., 1912, Vol. III, p. 41). In a modern baghouse, the filtering surface provided is 3.45 sq.ft. per cu.ft. of gas per min., but 2.5 sq.ft. is sufficient, as one division of the baghouse is always cut out of circuit for burning accumulated fume, cleaning and repairing. The question whether the baghouse is a profitable investment was discussed for the first time authoritatively. It is well known that baghouse fume runs high in lead and low in silver. The amount of lead recovered, and perhaps some additional advantage, must be the source of profit. Two examples are given: Murray, Utah, treating charges low in lead and not high in silver, and Omaha, Neb., where the reverse condition prevails.

At Murray, in 4.7 years the baghouse, costing $127,195, increased the lead extraction by 1.269%, saving a little copper, gold and silver. In treating 1,666,857 tons charge containing 177,346 tons lead the baghouse caused a loss of $58,746. If the arsenic of the flue dust had been recovered at Murray, the above loss would have been reduced to $24,101. The Omaha plant in 1910-11 treated in the blast-furnace division 74,112 tons of charge, running as high as 40%. The baghouse, costing $60,000, recovered 580 tons fume containing 230 tons lead and made a profit of $7684. The lead-copper matte converting department recovered, in treating 53,667 tons matte, 1551 tons fume containing 1325 tons lead. The baghouse, costing about $42,000, gave a profit of $98,712. It appears, therefore, that with low contents of lead and silver the baghouse does not pay for itself, unless it insures the works against other losses, such as lawsuits by agricultural interests, by delivering gases free from dust into the air.

At the congress, F. Heberlein remarked that in Europe the tendency was toward wet condensation, a system which is gaining much ground there.

The Cottrell electric condensation plant, which was erected at Garfield, Utah, to collect the lead fumes issuing from the copper-matte converters, has been built, but has not been put into operation; the reasons for this delay are not of a technical nature.

Blast Roasting

C. O. Bannister (*Trans.*, Inst. Min. & Met., February, 1912) carried on a series of experiments to furnish data for a theory of the process of blast roasting galena. The experiments, conducted in a gas-heated muffle, are extremely valuable in showing what a charge of galena, mixed respectively with limestone, silica and gypsum, undergoes in roasting, but they do not furnish a satisfactory basis for the elaboration of a theory of blast roasting.

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Desilverization

The development of the Parkes process in the United States was discussed by E. F. Eurich (VIII Int. Cong. App. Chem., 1912, Vol. III, pp. 79), who for many years was the foremost man in this branch of metallurgy. A few leading points may be noted. The capacity of the softening furnace for lead bullion has been increased from 90 tons with hand charging to 240 tons with machine charging. An endless belt elevates the pigs and drops them into a chute down which they glide into the furnace through a hole in the roof. Considering that it takes no more time to soften a large charge than a small one in a properly proportioned furnace, we have here a great advance. Another improvement, first used probably at Grasselli, Ind., is the removal of the lead from a kettle by a horizontal centrifugal pump driven by an electric motor. This works beautifully; one important advantage over the Steitz siphon, invented in 1877, is that the depth of a lead kettle is no longer limited to 40 in., so that a modern kettle can easily be made to hold 60 tons of refined lead.

Research

The investigations published in 1912 cover the properties of lead (allotropic modification, corrosion, purification), of alloys (lead-calcium, lead-tin, lead-tin-antimony, lead-tin-bismuth, lead-tin-zinc), and of compounds (PbS — Sb_2S_3, PbS — SnS, $PbCl_2$ — $Mg(Ca)Cl_2$, $PbSiO_3$, $PbSO_4$).

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The Metallurgy of Iron and Steel

By Bradley Stoughton*

Probably more attention was given in America in 1912 to improvement in the quality of iron and steel than during any other equal period of time, and this is particularly true of steel for rails, and of means for eliminating defects so liable to be found in ingots, namely: pipes, blow-holes, segregation and solid inclosures. Copper in small proportions, is a new addition to steel and the natural alloys of iron with nickel and chromium, known as Mayari iron and Mayari steel, were publicly described in 1912 for the first time. New impetus was given to the scientific study of cast iron, and to the determination of the "Widmanstätten structure" in steel. Several useful discoveries were made in the case hardening of steel and the ferromagnetism of steel and other alloys. In the manufacturing side of the industy, there were decided developments in the preparation of ores for smelting; in thin-lined furnaces and in drying of blast. The following novelties in practice were adopted: New chilled cast-iron process, new openhearth fuel, new openhearth raw material, new processes for casting small ingots, and new process for making charcoal wrought iron. Electric furnaces, the duplex process and mechanical puddling were installed in large plants not previously so equipped.

Improvement of Railroad Rails

The year 1912 will probably long be noteworthy for the amount of work done on the improvement of the quality of steel rails. Perhaps the most striking immediate result of the study given to this subject by both consumers and manufacturers, is the recently adopted extension of the field of inspection of manufacture, so that a small army of inspectors in the works records the history of manufacture of every rail produced. Hunt[5] and others have gone on record, that the great problem next to be solved is securing a sound ingot—that is to say, an ingot substantially free from segregation, slag inclosures, blow-holes, and a deep pipe. Then the laminated heads, streaked heads and flanges, and sharp fractures due to a veil of occluded alumina or other oxide, will become things of the past. The importance of distribution of metal between head, web, and flange has been shown by the published records[16] of the relation between the temperature and proportion of rail failures on all the Harriman lines. Records of the previous 80-lb. and 90-lb. A. S. C. E. sections showed that the average number of failures in the cold months of 1909, 1910 and 1911, was double or treble the number occurring in the warm months; with the 90-lb. section of the American Railway Association, the average number of failures in the cold months was substantially no greater than in the warm months, and always less than with the older sections.

Producing Sound Ingots

Likewise, 1912 will probably long be noted for the number of new and important processes developed to produce sound ingots. At the autumn meeting of the Iron and Steel Institute[6], Sir Robert Hadfield, Dr. J. E. Stead and Dr. Hans Goldschmidt each described a new method of avoiding pipes or blow-holes, or both. The Hadfield process consists in heating the top of the ingot by means of a charcoal fire and the result is seen to be a marked decrease in segregation, depth of pipe and amount of necessary discard. Stead described the process of Benjamin Talbot,[4] which consists in rolling the ingot before it has solidified inside, and so obtaining the advantages of liquid compression at lower cost. In the Talbot process we get the effect ordinarily found in rolling "green" ingots, namely, an impoverishment of non-ferrous elements in the center of the ingot, instead of segregation there. The new Goldschmidt process involves plunging a can of thermit to the bottom of the liquid ingot so as to free it from gases, oxide inclosures, etc., by the violent stirring produced by the thermit reaction.

Blow-holes and Slag Inclosures

The subject of slag inclosures was thoroughly treated by Packer and Mars.[1] A new process was adopted in the Obouchoff Steel Works for the prevention of surface blow-holes, and was described by Troubine[6,13]. The ingots are teemed through a sheet-iron truncated cone which is always suspended just above the surface of the liquid metal. The splashes of metal which would otherwise strike on the walls of the ingot mold and adhere there, are caught by the walls of this cone, which is entirely

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encrusted with them when pouring is over. Since this practice has been in vogue, the ingots have been free from surface blowholes. Stead[6] published part II of his study of the welding-up of blow-holes, which publication is said by Howe to be the most important contribution on the subject ever published. Stead announces the following conclusion: "It seems reasonable to believe that under the ordinary treatment to which honeycombed ingots of steel are heated and rolled, internal small cavities or blowholes do become perfectly welded up, provided there is an absence of sulphide segregations. * * * * * It also seems justifiable to conclude that surface blowholes which become oxidized on their walls during the heating and rolling of the ingot, do become more or less completely welded. The conditions favorable to this welding must be a sufficiently high temperature and maintenance of the steel at that temperature for a long enough period after the cavities have been closed, to admit of the carbon in the adjacent steel being afforded the opportunity to reduce the oxide scale." Austin[6] melted samples of cast iron in a closed electric furnace and collected the evolved gases; they consisted chiefly of hydrogen plus nitrogen (which, unfortunately, were not determined separately), with 23 to 59% CO and some CO_2. The CO_2 was much more abundant in cast iron and mild steel than in crucible and medium-carbon steel. The amount of gas collected was least in cast iron and greatest in crucible steel.

Effect of Different Constituents on Steel

Much work has been done on the equilibrium diagrams of Fe-FeS and Fe-MnS in past years[20] and this has been of advantage in the important question of sulphur in steel. Becker[1] and Loebe continued the Fe-FeS investigation, while Roehl made a great stride in advance by studying the system FeS-MnS. He finds a new constituent, $Fe_3Mn_2S_5$, which melts at 1360° C., as compared with 1188°C. for FeS and 1620°C. for MnS. It is evident that the double sulphide will enable the desulphurizing action of metal mixers to take place more easily than the sulphide or manganese would do, and also that the double sulphide enables a small amount of sulphur to exert a greater effect on the steel than it would in the form of MnS. Charpy and Bonnerot[2] show that hydrogen rapidly permeates steel at all temperatures above 350°C. and that nascent hydrogen has a special chemical activity in diffusion. Sieverts[12,6] finds that the solubility of melted iron for hydrogen increases proportionately with the temperature, and also increases suddenly when the metal melts. On solidifying, iron gave up seven volumes of hydrogen. De Nolly and Veyret[2] state that many substances used for carbonizing steel disengage hydrogen on heating, and that it is absorbed hydrogen which causes cemented steel to be so often fragile and to have coarse-grained, brittle cores. Andrew[6] finds that iron and steel absorb nitrogen when melted under a high pressure of the gas; that 0.3% nitrogen entirely suppresses the critical changes of pure iron; that 0.25% nitrogen markedly lowers the Ar_1 point of a steel containing 0.6% carbon, and that this steel could only be freed from nitrogen by several weeks heating *in vacuo*.

The use of about 0.25 to 0.30% of copper in steel for rails attracted a good deal of notice and the results of service tests of these rails is awaited with much interest. Steel tubes also were made with copper up to about 0.50% with the expectation of benefitting by the increased resistance to corrosion of such cupreous steel. The difficulty of welding such steel has, however, militated against its more extensive use.

Properties and Uses of Cast Iron

One of the most important investigations on charcoal cast iron ever published appeared in 1912 from the pen of J. E. Johnson, Jr.[3]: By means of complete chemical analysis, metallographic examination, and, finally, the assignment of each grade of iron to its proper place in the iron-carbon equilibrium diagram, he determined some of the factors which produce good and bad charcoal iron, and also gave us the first satisfactory explanation of the cause of cast iron with a white center and gray exterior. This "spotted iron" is often found in the Swedish product and may be produced from almost any iron not too high or too low in silicon by pouring it into sand at a low temperature. Herbert E. Field had explained its cause on the ground of pressure, as follows: The interior, which is still liquid after the exterior has solidified, is put under such pressure (by the separation of graphite from the exterior shortly after its solidification) that the interior cannot separate graphite when it reaches the appropriate point to do so.

Johnson pointed out that, if this were the only cause, then all irons would be white inside. Johnson found, however, that the white center is a eutectic of iron and carbon, and that the action occurs more readily in hyper- than in hypo-eutectic irons. Since these "spotted irons" are low in quality, and are often troublesome in foundry practice—especially in malleable foundries—this observation is of real practical value. Rugan[6] and Messerschmitt[6] continued the study of growth of cast iron on heating and cooling, and Campbell and Glassford[5] extended these studies to the problem of the failure of cast-iron fittings for superheated steam and show that the difficulty is caused partly by growth and partly by oxidation between the grains of the iron. Von Emperger[1] suggested using cast iron for reinforced-concrete columns, instead of steel. He found that a cast-iron column, 14 cm. in diameter and three meters long was increased in strength from a breaking load of 137 tons to a breaking load of 321 tons by a covering of concrete 29 mm. thick. Schoettler[18] gave a valuable series of tests of cast iron of different sections.

The Mayari iron ore of Cuba, after nodulizing, contains about 55% iron, 13% alumina, 2% chromium, and 1% nickel plus cobalt. These ores can be smelted in blast furnaces, either alone or with other ores, and produce a pig iron containing up to nearly 3% chromium and 1.5% nickel. It was discovered by accident, according to Bent,[10,16] that this Mayari iron could be mixed with other irons to make a superior quality of casting as regards wear, strength, finish and closeness of grain. It is now in much demand for chilled castings and others of excellent strength or finish.

"Ferro-cementine" is a new brazing compound used for making the brazing stick better to the cast-iron surfaces. The metallic base of this ferro-cementine alloy is copper.

Welding of Steel

Bermann[5] tells us that an oxidizing flame should be used for heating surfaces that are to be welded, lest otherwise the steel take up carbon from the coal. The spark test, he says, is the best method of learning whether such an absorption has occurred, and the best mechanical test is to bend the weld to and fro at a red heat, unless it is a question of passing acceptance tests, when alternate torsion or bending at ordinary temperatures should be applied. Finally, he concludes, that the presence of manganese in the steel is favorable because it reduces the crust of oxides. As to autogenous welding, he concludes that a reducing flame is the better and that the material melted should have the same composition as the pieces to be welded together; then, if the spark test is aplied to test absorbtion of carbon, the weld should have the same character as the welded pieces. In this latter opinion, Bermann is contradicted by Stanton and Pannell[6], who found that welds made by the oxyacetylene process were not comparable with those made by either the hand or the electric process. Perhaps the spark test would have revealed the reason for the inferiority of the autogenous welds they tested. As to hand and electric welding, Stanton and Pannell found that hand welding gave substantially the same result as electric welding for iron, namely, 89% efficiency, while electric welding of steel gave much better results than hand welding, 93% and 82% respectively. A new process for the welding of tubes from skelp consists in heating only the edges that are to be united, by means of the oxyacetylene flame, thus avoiding heating about 80% of the skelp unnecessarily. The process of "flameless combustion" is suggested as a still cheaper means of accomplishing the same result.

Heat Treatment of Steel

Sauveur[5] discovered that, if soft steel be subjected to a certain critical strain, it makes it especially liable to growth of the grains during subsequent heating for a long time at low temperatures. This observation is of importance in connection with the manufacture and use of steel tie-rods for furnaces, etc. Portevin and Bernard[2] found that events which might occur during the forging of steel will produce the structure known as "Widmanstätten's." These events are : Too long sojourn in the zone where austenite is normal, and too rapid cooling during the separation of ferrite or cementite, i. e., during secondary crystallization. Belaiew[14,1,2] has contributed a study of the crystallization of steel, and of the Widmanstätten structure, which has caused the Russian artillery to announce that the visibility of the Widmanstätten structure at any magnification up to 50 diameters is sufficient cause for rejecting the material. Belaiew states that the primary crystallization of steel consists of dendrites built up of octahedrons, and that these dendrites can be seen with the naked eye after prolonged attack with acids; furthermore, that the austenite region of the iron-carbon equilibrium diagram is the zone of granulation, and this granulation may be revealed by attack with hydrochloric acid at high temperatures; the secondary crystallization is affected by the preceding events, he says, and, with rapid secondary crystallization, we get the Widmanstätten structure. Belaiew further says[2] that macroscopic examination is useful for telling us the stable structure of steel, while microscopic examination discovers more the events of recent heat treatment. Haneman[1] and Steinberg[13,2] discussed the refining of steel by heat treatment; Sherry[7] studied the coarse crystallization of soft steel and Oberhoffer[1,10] treats ably of the refining and annealing of steel castings.

Sauveur and Rheinhardt[3] suggested that, since some alloy steels are normally in the pearlitic condition at atmospheric temperatures when the carbon in them is low, and the same steels will be normally in the martensitic or austenitic condition at the same temperatures when the carbon is high, that we may case harden such steels without quenching, by simply carbonizing the outer layers. Giolitti[1] continued his exhaustive studies of cementation and announces that he has found that carbon alone can cement steel, but weakly. The researches of Charpy and Bonnerot[2] contradicted this statement and corroborate the earlier investigations of the same authors to the effect that, near 950°C., solid carbon cannot penetrate steel or iron without having a gaseous vehicle. Abbott[3] and Guillet[23,10] gave us some useful data upon the best carbonizing materials and methods to use with different articles to be cemented; Lothrop[15] studied the effect of several variables; Nead and Bourg[10] discussed the time required for heating various carbonizing substances, and Ammon[3] developed a test, which is a combination of the Brinell and Shore tests, to tell the depth to which effective hardening has extended. A French process of partial carbonizing, which is said to be new, consists in covering part of the surface with some metal like copper or nickel, to prevent the carbon penetrating there, and thus getting surfaces which are case hardened in some places and soft in others[8]. In order to avoid explosions in carbonizing practice, de Nolly and Veyret[2] studied the gases disengaged by various carbonizing materials: They found that there is much evolution of gas between 300 and 700° C., and that this gas consists chiefly of hydrogen, carbon monoxide, hydrocarbons and nitrogen. It is the hydrogen, they say, that causes cemented steel to be so fragile. To avoid explosions, they advise heating very slowly to 700°, avoiding animal and vegetable cements in favor of wood charcoal mixed with 30 to 50% of carbonate of barium.

Alloy Steels

Boudouard[2] investigated the electric resistance of special steels and Clamer[6] patented a white, noncorrosive alloy containing 65% iron, 25% nickel and 10% copper, with 0.2% carbon. It is said to have the following admirable physical properties: tensile strength, 96,100 lb. per sq.in.; elastic limit, 51,750 lb. per sq.in.: elongation in 2.0 in., 42%; reduction of area, 53.7%. Campredon[8] described some improvements and new uses of vanadium steels, and the effect of vanadium in tool steel was extensively discussed.[10] Novelties on the heat treatment of chromium steels were also described.[10] New uses for titanium steel continue to be found, and doubtless over a million of tons of this "cleansed" material were made in 1912.

A new and natural alloy of iron, nickel and chromium attracted much attention in 1912, and is sold under the name of "Mayari steel." It consists of pig iron smelted from the Mayari ores of Cuba and then purified in an

openhearth furnace. A steel is produced containing phosphorus and sulphur below 0.04% each; manganese, 0.50 to 0.80%; nickel, 1.00 to 1.50% and carbon and chromium varying according to the grade of hardness desired, from 0.25 to 0.50% carbon, and from 0.10 to 0.40% chromium. Vanadium and titanium are sometimes used in combination with these alloys. The Mayari steel is used wherever an extraordinary combination of strength or hardness with ductility is desired; after appropriate heat treatment, it may have an elastic limit of nearly 200,000 lb. per sq.in. with an elongation in 2.0 in. of 10%, and a reduction of area of 32%; or else, we may get an elastic limit of nearly 100,000 lb. per sq.in. with an elongation of 25% and reduction of area of 65 %. This remarkable steel has been used for track bolts, heat-treated eye-bars, railroad rails, crankshafts, axes, tools, springs, etc. On account of its nickel and chromium it is especially adapted to case-hardened articles.

Magnetism of Iron

From the laboratory of the Creusot works[5] came a research on the magnetism of iron at different temperatures, which states: The disappearance of magnetism reveals not only Ar_2 but also Ar_1; that there is a decrease of permeability at about 200° C. which corresponds with the disappearance of magnetism from iron carbide; that a highly oxidized steel shows abnormal hysteresis and coercive force which disappears at about 250° C., and appears again at a slightly lower temperature on cooling; that a quenched steel showed a maximum permeability and an abnormality in its dilation curve near 300° C. Weiss[5] studied the magnetic properties of compounds of iron with nickel and cobalt; he found that the compound, Fe_2Co, has 10% more saturation intensity than pure iron, and that Fe_2Ni is also important magnetically. This latter observation obtains confirmation from the researches of Hilpert, Colver-Glauert and Mathesius[1], who found that nickel-steel containing 33% nickel had abnormal magnetic properties. The same authors proved that α iron is not the only magnetic variety; that the magnetizability of manganese and nickel steels was greatly increased by quenching at 1200° C. and by annealing between 400 and 450°, as the result of a new state being formed. Gumlich[7] stated that the coercive force increases and the remanence decreases proportionally to the amount of dissolved carbon in steel, and that silicon improves the magnetic properties by throwing carbon into the carbide or the graphitic form. Paglianti[22] found that silicon decreases the electric conductivity of steel, and that heat treatment has no effect upon this influence; that 2% of silicon gives the best magnetic results and that a special heat treatment at red heat gives such steels their best magnetic qualities. Waggonner[6] wrote that the relations between the hysteresis loss, intensity of magnetization, maximum susceptibility and the carbon content of a series of unhardened steels might have been predicted from the Ewing theory of magnetism and a knowledge of the physical characteristics of the microscopic constituents of such steels.

Heyn[5] and Rosenhain[24,1] discussed the metallography of iron and steel down to the beginning of 1912, and gave us most useful introductions for the discoveries of that year. Benedicks[6] announced that the change from one allotropic modification to another is not a sudden one, but that γ iron, for example, is soluble in α iron, to some extent. and that, on this basis, iron is not an allotropic modification, but is α iron containing a limited amount of γ iron is solution. Robin[5] argued, from a synopsis of published results, that iron has two allotropic change-points, namely, between 100 and 250° and about 500°C. Ruff[25,3] and Wittorff[26,3] have investigated the alloys of iron containing more than 4% of carbon, at temperatures up to about 2500°C. The work of these two contradicted one another to some extent, but the result was greatly to clarify our knowledge of the iron-carbon equilibrium diagram and the constitution of cast iron and malleable cast iron. Wittorff explained the observation of Osmond, and of operators of electric furnaces, that iron containing much carbon will become solid if heated to too high a temperature. Wittorff also discovered the primary crystallization of graphite to a slight extent in the stable equilibrium diagram, as well as the primary crystallization of iron carbides, such as: FeC_2, FeC, Fe_3C, Fe_4C.

Blast-Furnace Improvements

Johnson[3,10,16] devised a blast-furnace construction in which four columns, set well out from the furnace, support four I-beams, which, in turn support the stack itself by means of brackets. This not only gives much better access to the furnace bosh, but saved important time in the building of the furnace after a shutdown. The thin-lined furnace is gradually finding its appropriate place in the manufacture of pig iron. Some furnaces have been built with linings too thin—nine inches is not sufficient for the demands of daily service and 12 in. is probably about the correct mean. Some[21] even go so far as to say that this type of furnace has not really come to stay.

Recent changes in blast-drying apparatus tend to cheaper costs for installation; one of the latest of these is a two-stage process, whereby the air is cooled by water in an outer, annular ring of the drying chamber, and then cooled further by direct contact with cold brine in the inner space. This method avoids the necessity for freezing out the moisture with subsequent de-frosting, and gives greater efficiency in cooling on account of direct contact, besides greatly cheapening the installation cost. European practice frequently enriches the blast with oxygen in varying amounts as needed, in order to accomplish the same regularity of conditions and heightening of hearth temperature over critical temperature, which the dried blast accomplishes. Lührman[1,10] reported the result of this practice at some of the furnaces: The oxygen is added in the form of enriched air, containing 50% oxygen and 50% nitrogen, which may be made at the furnace itself if desired. The cost appears to be about 50c. per ton of iron made for oxygen enough to raise the temperature of the hearth by about 50° C. The granulation of slag by means of air instead of water has advantages where water is scarce or where it is desired to produce the granulated slag in a dry state[21,10]. Porter[3] suggests a new standard of cost keeping for blast furnaces. His plan is to establish certain standards of efficiency and to judge the economy of operation by comparison of costs with these standards, instead of by an arbitrary comparison of figures which may be only confusing under different conditions of raw materials, labor, etc.

Iron Foundry Changes

West[17] devised a method of producing chilled iron castings by sudden cooling with water instead of with metal "chills" placed in the sand mold. A German foundry has been mechanically charging its cupolas with a degree of success which contradicts the discredit cast upon this innovation by those who claimed that a uniform melting could not be thus obtained. The Germans also studied the problem of permanent molds[1]. The regenerative openhearth furnace has been used for some years for the manufacture of malleable cast iron, on account of its greater control over the chemical reaction and the temperature and its lower cost for fuel and hearth repairs than the air furnace; now an American foundry is installing an openhearth furnace for making high-grade castings of gray iron.

New Openhearth Practice

The increasing price of oil and the growing production of tar on account of the increase in number of byproduct coke ovens, has caused tar to again become interesting to furnace managers as an openhearth fuel. Important interests have taken this practice up and no doubt it will have many advocates. The idea is by no means new. Coke-oven gas is also rapidly growing as an openhearth fuel and there are more plants using the maximum amount of excess gas for this purpose, and even using blast-furnace gas to heat the coke ovens in order to get more oven gas for the openhearth furnaces. There is a new raw material for openhearth furnaces which seems to have usefulness where coke, pig iron and scrap are high in price. This new material is an iron sponge, containing about 97% iron, 1.4% gangue and 1% oxygen. It is made by subjecting iron ore to a stream of carbon-monoxide gas at temperatures below the melting point of iron. For localities where the smelting of iron is costly on account of lack of coke, and where carbon monoxide gas may be cheaply obtained from peat, oil, etc.—localities like California, for instance—this process would seem to have an important future. Carr[10,16] put in operation several openhearth furnaces of small size, made with the hearth entirely inclosed in steel and so arranged that it can be picked up by a crane and used as a ladle to pour steel into molds. The purpose is to save the loss of heat consequent upon pouring the steel from the furnace into a ladle, and the furnace is especially adapted to the manufacture of castings.

Electro-Metallurgy

Two new American foundries built electric furnaces for the manufacture of steel castings, and the Bethlehem Steel Co. is now installing a large furnace of the Girod type to super-refine the steel from its bessemer and openhearth furnaces. This will make an important addition to our present electric steel-making furnaces, none of which has ever operated at anything approaching its maximum capacity. The electric melting of ferromanganese, in order to add it as a recarburizer in the liquid condition attracted much attention during the last year[1,10], some interesting details of the manufacture of high-grade ferrosilicon in the electric furnace also appeared,[7] and the cost of this manufacture is said to be less than the preliminary estimates made for it[2]. The smelting of iron ore progresses satisfactorily in California, and the pig iron produced is of good quality and can be made especially suitable for cheap conversion in the openhearth furnace[7,8,16]. In Sweden, the production of pig iron is increasing rapidly and much technical progress is being made with the process[19,1]. There are now about 70 electric furnaces in active operation, including both ore-smelting furnaces and steel-melting or refining furnaces.

Miscellaneous Improvements in Steel Practice

The duplex process is to be extended to two more large American plants; in one case in connection with Talbot furnaces, and in the other with the usual type. The casting of small ingots has advantages where small products, like billets, are to be produced, but the mechanical difficulties of teeming and handling so many units are great. For instance, an ordinary, modern American openhearth could produce about 75 ingots weighing a ton each, every time it made a cast. A German[1,10] and a French[2,10] process for avoiding these difficulties were developed and put in practice in Europe. In the French system, the ingots are cast by the bottom-pour method in batteries; the ingot molds are split, and a battery of molds is held together by a pair of hydraulic presses. This cheapens the cost of stripping and setting up. In the German system, the ingots are also bottom-cast into molds much like the ordinary type but having ears and keys, so that a whole battery of molds can be handled at one time by a crane with suitable spreaders. The ingots are also handled in batteries by a similar device. Ingots as small as 150 lb. weight have thus been cast commercially. A new steel-casting converter has been installed in several foundries in Europe and America. Its novelty consists in means by which the pig iron for conversion can be melted with oil in the converter itself previous to each blow. The time of melting is said to be 1¼ hr. The advantages are the saving of heat and saving the cost of a cupola; the disadvantages are the waste of iron, irregularities in time of operation and heavy installation costs on account of the recuperative system employed. A process of rolling special shapes such as hinges, wrenches, chain links, etc., instead of drop-forging, consists in cutting the dies in upper and lower roll and then having means to assure their coming above one another during rolling. It has been adopted by a German mill and is said to have several advantages.[10]

A New Charcoal Iron Process

For some purposes charcoal wrought iron is without an equal. It has long been made by the old crude process which is costly in comparison with the newer processes of iron and steel manufacture. Now a new process is being operated by a works near Philadelphia, and is said to have several advantages over the old process; notably cheaper working costs and greater uniformity and higher grade of product. An openhearth furnace is used in this new method; this is first heated by oil or gas and then a layer of charcoal is spread on the hearth and the charge of pig iron placed on top of it. A layer of charcoal goes on top of the iron; then cold air from suitably placed tuyeres burns the charcoal, melts and boils the iron in the usual way. The melted metal trickles down through the lower layer of charcoal. More charcoal is added at intervals if needed, and is always added at the end to expel

any gases that may arise. The impurities are oxidized by the cold blast in the usual way. A layer of slag intervenes between the iron and the charcoal on top of it. When the purification is complete, the liquid iron is tapped and poured into ingots. It is claimed to have exceptional purity and to be under better control because analyses can be made before the charge is removed from the furnace.

One of the largest manufacturers of wrought iron in America has installed and is operating the Roe puddling furnace and the results of continuous commercial operation are awaited with great interest.

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[5]Proc., International Association for Testing Materials, 1912.
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[11]Iron and Steel Institute, Carnegie Scholarship Memoirs, Vol. IV, 1912.
[12]Zeit. für physikalische Chemie, Vol. LXXVII.
[13]Journal Russian Metallurgical Society.
[14]Annals of the Imperial Russian Technical Society.
[15]Proc., American Society of Mechanical Engineers, 1912.
[16]Iron Trade Review, 1912.
[17]Trans., American Foundrymen's Association, 1912.
[18]Zeit. des Vereins deutscher Ingeneure, 1912.
[19]Jernkotorets Annaler, August, 1911, and March, 1912.
[20]Metallographie, 1909, 1910, 1911, 1912.
[21]Eng. and Min. Journ., 1912.
[22]Die Metallurgie, Vol. IX, 1912.
[23]Le Genie Civil, Abs. in Iron Age, Apr. 11, 1912.
[24]Proceedings, Staffordshire Iron and Steel Institute, 1911.
[25]Die Metallurgie, 1911.
[26]Journal, Russian Chemical Society, Vol. 43, 1911.

The Metallurgy of Copper in 1912

By Arthur L. Walker*

In 1912 more than the usual number of large copper smelteries were completed and placed in commission. While these plants have been built along the same lines as the most modern of those already in existence, a marked improvement can be noted in the tonnage treated in furnaces of a given size, which is especially the case in blast furnaces and to a less extent in reverberatories. The reason is undoubtedly due to the improved physical condition of the charge, as at present all fine material delivered for blast-furnace smelting is first carefully sintered so that the amount of fines in the charge is reduced to a minimum.

New Copper Smelteries

The new smeltery erected by the American Smelting & Refining Co., at Hayden, Ariz., was completed and put into operation in April, 1912. At this plant there are no blast furnaces and all of the material is smelted in two 19x112-ft. reverberatories. These furnaces treat the concentrate from the Hayden mill of the Ray Consolidated Copper Co., and put through 300 tons of charge daily. The charge is made up of about 80% of concentrates and 20% of crude ore, the concentrate being roasted prior to charging in the reverberatory furnaces. The matte produced contains 40 to 42% of copper and is blown to blister in two Peirce-Smith converters 10 ft. in diameter by 25 ft. long, the capacity of each converter being approximately 40 tons of copper per day. The blister copper is shipped to the electrolytic refineries at Baltimore, Md., and Maurer, New Jersey.

At the smeltery of the Mason Valley Mines Co., in Mason Valley, Nev., which was blown in last spring, blast furnaces only are used. There are two of these furnaces, 42 in. wide by 25 ft. long at the tuyeres, and each of these furnaces has a capacity of 750 to 800 tons of charge per day. The tonnage has exceeded 9 tons per day per square foot of hearth area at the tuyeres, which is an excellent record for this size of furnace. The flue dust is mixed with ½ to 2% of fine coke, moistened to contain about 8% of water, and sintered on two Dwight-Lloyd sintering machines. This gives an ideal product for the blast furnaces.

The Calumet & Arizona company is now erecting a new smeltery at Douglas, which will contain two blast furnaces, 48 in. wide by 40 ft. long, and four 19x100-ft. reverberatories. Provision has been made for the erection of a fifth reverberatory furnace. The roasting furnaces are of the Herreshoff-Great Falls type, 12 ft. in diameter. This is rather a departure from the size of the large cylindrical, multiple-hearth roasting furnace, which in recent years has usually been built with a diameter of 18 ft. It is expected that this plant will be completed by the middle of next summer. The Shattuck-Arizona company has abandoned the project of building a smeltery of its own at Douglas, and instead has made a contract with the Calumet & Arizona company for treating its ore. Work is in progress on new smelting plants for the United Verde Copper Co., at Jerome, and for the Arizona Copper Co., at Clifton.

Copper Converting

Again in the last year there has been a material increase in the use of basic-lined converters for treating copper matte, and at the present time about 95% of the copper bessemerized in this country, is produced from basic-lined converters under the patents controlled by the Peirce-Smith Converter Co. Not only is this lining now used for horizontal converters as originally designed, but also for the vertical type. In fact, this latter type of converter, which has been so satisfactorily employed at the Aquascalientes, Mexico, plant of the American Smelting & Refining Co. and at the Great Falls plant of the Boston & Montana company, Great Falls, Mont., is again coming into favor, and vertical converters are now being installed in several important plants. The question of the relative value of the horizontal *vs.* the vertical converter for treating copper matte has not yet been decided, but according to Mr. Peirce, president of the Peirce-Smith Converter Co., the relative operating economy of these two types of converters is not of such great importance at the present time, as whichever is used, the cost of converting in a well conducted plant, excluding the treatment of by-products, is now below $4. This does not leave a wide margin for improvement. When we consider that at the present time it is nothing unusual to treat 10,000 or 15,-

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000 tons of copper matte in a converter without having to change the lining, compared with the former practice of using siliceous material and relining converters after treating 25 to 50 tons of matte, we realize the value of the basic-lined converter and can appreciate the enormous saving which has been made by its satisfactory introduction.

Fume Condensation

The tremendous agitation which occurred a few years ago, in regard to smeltery smoke, has, to a great extent, ceased, owing largely to the shutting down of certain copper smelteries where the damage done was greatest, and the removal of this work to other centers, also the increased precautions which have been taken by other plants to prevent the discharge of a large amount of sulphur in the shape of gas into the atmosphere. The question, however, is not settled by any means and is likely to come up again in the future.

At present the problem of collecting valuable materials which escape in furnace gases is being carefully considered and the Cottrell system which was so successful in collecting solid matter from the gases at the Balaklala smeltery, in Trinity County, Calif., is being used for this purpose. At the Balaklala smeltery about 75% of the solid matter in the shape of dust, sulphuric acid and sulphur trioxide contained in the gases was collected by this process. Improvements have now been made in the design of the condenser and it is stated that considerably over 90% of the fine dust and fume in furnace gases can be collected.

At the Garfield plant of the American Smelting & Refining Co., the Cottrell system is being installed to recover solid matter in the shape of dust and fume from the gases coming from the copper converters, and it is expected that the value of the material recovered in gold, silver, copper and lead, will be considerable. The outcome of this operation will be watched with a great deal of interest, as undoubtedly the loss in converting copper matte containing precious metals has been more than many metallurgists have appreciated, and if the recovery of these losses can be efficiently accomplished by the Cottrell system, the process will be widely introduced.

At the Raritan Copper Works, an experimental installation of the Cottrell system to precipitate solid particles from the gases in the flue leading from the silver cupel furnaces gave such satisfactory results that a regular plant is now being installed to collect the dust and fume which escape in these gases, and by means of this installation a more satisfactory recovery is expected than by the old system of flues and scrubbers. The Cottrell system is also being installed at the Balbach smelting and refining plant, at Newark, to precipitate material from the gases coming from the cupels in exactly the same manner as the installation at the Raritan Copper Works, at Perth Amboy, N. J.

The Thiogen Process

As stated a year ago, the problem of eliminating sulphur dioxide from fumes has been investigated by Prof. Stewart W. Young, of Stanford University, Calif., and as a result he has patented what is known as the thiogen process. In this process, by means of hydro-carbons, the sulphur oxides in furnace gases are reduced to elemental sulphur, which can be more easily marketed and made a source of profit in situations where it would be impossible to dispose of sulphuric acid. A plant to apply this process to the gases coming from McDougal roasters, has been installed by the Penn Mining Co., at Campo Seco, Calif. It is claimed that substantial progress has been made in treating these gases and that the SO_2 content is reduced to one part in 50,000, the reduced sulphur collecting in a condensing chamber.

Hydrometallurgical Processes

Much attention was devoted to wet methods for recovering copper from its ores, but up to the present time it cannot be stated that any of the numerous experiments made in this direction in 1912 have been successful. It is rumored that a plant has been built in California which is treating 400 tons of ore per day and recovering pure copper by a wet process, but as yet no reliable data have been published in regard to it. The experiments which have been made in leaching at the plant of the Shannon Copper Co., were not successful. The complete installation of the Bradley process at Anaconda was delayed, owing to mechanical difficulties which had to be overcome, but it was expected that operations would be commenced again in December. The chemistry, which was described a year ago in the Journal, has not been changed in any respect. Attempts have also been made to roast the copper in low-grade ore to a sulphate, leach with water and then electrolytically deposit the copper, but the mechanical and metallurgical difficulties have proved too great to be overcome by the method proposed at present.

An extensive undertaking from which much is expected is being made in Chile by the Braden Copper Co., where a plant to extract copper from the concentrate produced, which runs about 20% copper, by a wet method, is now about completed. The concentrate will be roasted so that the iron will be in the form of an insoluble oxide, and the copper mainly as an oxide with a small amount as sulphate. The fumes from the roasting furnace will pass through a condenser, when the SO_3 will be recovered as sulphuric acid, which will be used for leaching the copper from the roasted concentrates. The supply from this source will be ample. By this method it is expected to obtain an extraction of 95%. The solution from the leaching operations will carry 5% copper and be delivered to electrolytic tanks, when the copper will be deposited on prepared copper cathodes, the operation being continuous till the copper content of the electrolyte is reduced to 1½%. It will then be run back to the leaching plant and, after the addition of more acid, used again. Provision, however, will be made to remove one-quarter of the electrolyte daily in order to prevent impurities, which are dissolved from the concentrate, accumulating, and by this means it is expected to keep the electrolyte sufficiently pure to make good electrolytic copper. This leaching process, at the Braden Copper Co.'s plant, will be in competition with the smelting and converting method for treating these concentrates, and the result will be watched with a great deal of interest. Fortunately, at this property, the cost for power for the electrolytic work is low.

The difficulties which the metallurgist must overcome in order to introduce a satisfactory wet process for treating copper ore are fully recognized, but the demand for such a method at present is great and a successful solution of the problem is hoped for in the near future.

The Metallurgy of Zinc

By W. R. Ingalls

In the metallurgy of zinc there is a great deal of experimental work going on all of the time, there are steady improvements in the details of conventional practice, occasionally there are new developments designed and put successfully into operation for the treatment of special kinds of ore, but there is seldom anything of revolutionary character or wide-spread bearing to chronicle.

Zinc smelting was begun in Japan in 1912 at Amagasaki, near Osaka, where two furnaces, each comprising 60 retorts, were in operation. A plant of three furnaces, each comprising 120 retorts, is in course of erection near Kasaoka, on Konoshima Island, in the Province of Okayama. This plant is expected to be ready for operation early in 1913. At both these plants, which are considered by the Japanese to be of experimental character, the furnaces are regenerative and have the Rhenish form of retorts.

Roasting Furnaces

In Europe, furnaces of the old Maletra type, but greatly improved, as exemplified in the designs of Delplace, are being built more and more. The object in Europe is to economize fuel, which there is relatively expensive. In America, fuel is cheap, and we do not have to pay so much attention to economy in its use. Consequently, our smelters in the natural-gas field adhere to the Zellweger furnace, although that is frightfully wasteful of fuel. In the coal fields, everybody builds the old Hegeler furnace, which is clumsy and only semi-mechanical, because apparently nobody knows what else to do. The smelters in the natural-gas fields are now paying the penalty for their neglect to develop an economical furnace, the cost of natural gas having risen to so high a figure that no longer may it be wasted with impunity. This led, during 1912, to calamine ores being accepted gratefully upon a low margin for smelting, no roasting being necessary in their case, while for blendes, high margins were demanded and obtained. Several of the smelters are firing their roasting furnaces with oil, but this does not help matters much, because oil itself is a relatively costly fuel in Kansas and Oklahoma. Some gratifying experiments with a furnace of the McDougal type were made in 1912, and this may become the furnace of the future, combining full mechanical qualities with the ability to roast the ore with a minimum consumption of fuel and delivery of a gas of sufficiently high tenor in sulphur dioxide for sulphuric-acid manufacture.

Distillation Furnaces

A similar difference in tendency, governed by conditions, obtains with respect to the distillation furnace. The costly coal of Europe necessitates careful attention to economy in its use, i.e., heat recuperative furnaces of elaborate construction. There is some progress in this direction in America, but it is not yet general, probably because it does not have to be. American smelters continue to prefer the long furnace with the small cylindrical retorts. Furnaces of the Rhenish type are in use only at Pueblo. American metallurgists who have worked with both express a preference for the best type of the furnaces used in Illinois. At the new Hillsboro works of the American Zinc Co., the furnaces are fed with air delivered by blowers. Heat recuperation is effected through the medium of steam boilers. In Europe we find such modern constructions as those of Schmidt & Desgraz, Dor-Delattre, and Folliet.

An example of the European tendency in furnace construction is afforded by the furnace designed by A. Folliet, and erected by him at the Corphalie works in Belgium. This furnace is of the reversing regenerative type, but differs from the ordinary in that the movements of the air and gas are controlled independently. The air regenerators are in the lower part of the massive and the gas regenerators are at one end, and products of combustion being divided so as to pass out through these respective parts. The preheated gas and air pass through canals erected upon the roof of the furnace, from which they enter the combustion chamber in a downward direction. The furnace is divided not only by a longitudinal wall, but also by numerous transverse walls, the massive being thus divided into a plurality of small furnaces, so to speak. In his patent specification, Mr. Folliet says:

> In operation the furnace possesses numerous advantages. The control is excellent and the retort chambers are not subject to temperature fluctuations. Moreover, the temperature maintained is uniform throughout the entirety of the furnace, irrespective of the length thereof. Any pair of opposite chambers may be regulated or cut off independently of the others, without effecting in any way the operation of the remainder of the furnace. There is no danger of a formation of darts or jets of flame or sudden or uneven combustion, even when forced draft is employed. These results are due to the sectioning of the combustion chambers and the arrangement so that the air and gas enter each chamber independently of the other chambers of the same series, and partly to the special formation and arrangement of the groups of air and gas ports for the several chambers. Further, owing to the ability to instantly vary the proportions of the products of combustion passing through the air and gas regenerators, all danger of explosions is removed. All of the parts of the furnace are readily accessible during operation.

In a letter to me, Mr. Folliet said that three of these furnaces had been installed in the Corphalie works, the capacity of each being 11,000 to 12,000 kg. of ore per 24 hours. The consumption of coal (anthracite fines of 5-15, or 6-20-mm. size) is 850 to 900 kg. per ton of ore, and the extraction of zinc is 91 to 92% of the contents of the ore. This is phenomenally low fuel consumption. I may add that the position of the gas and air flues and gas regenerative chambers in the Folliet furnace tends to reduce the loss of heat through roof and end radiation. The Folliet furnace is supplied with gas from independent producers of Mr. Folliet's design, which resemble some of the standard American cylindrical gas producers.

Mr. Pape, of the International Zinc Co., Hamburg, Germany, experimented at Billwärder during 1912 with a furnace comprising vertical retorts, but so far as I have heard he has not yet come to any conclusive results.

An interesting feature of 1912 was the installation of a Saeger furnace charging and discharging apparatus by the National Zinc Co., at Bartlesville, Okla. This apparatus is in use at Silesia, but heretofore has not been introduced in the United States; nor in fact does mechanical charging exist anywhere else, although the New Jersey Zinc Co. several years ago tried it experimentally.

Heat Balance of a Siemens' Distillation Furnace

In *Metallurgie,* Nos. 10, 11 and 12, for 1912, Dr. F. Eulenstein presented a remarkably competent and painstaking study of the heat balance of a Siemens' zinc distillation furnace. The paper may be commended to anyone who desires to make an analytical study of the details of zinc distillation. Dr. Eulenstein accounts for the heat supplied to such a furnace as follows: Lost in the chimney gas, 50.85%; discharged in the retort residues, 2.67%; in the spelter, 0.45%; in discarded retorts, 0.19%; in the gas issuing from the condensers, 2.76%; consumed in the endothermic reaction in the retorts, 10.96%; lost by radiation and conduction, 32.12%. Dr. Eulenstein points out, however, that the loss by radiation is not wholly a loss, inasmuch as part of the heat radiated from the front of the furnace is necessary to maintain the condensers at the proper temperature for the performance of their duty. This remark illuminates the experience of some experimenters with electric furnaces, who have found it necessary to heat their condensers by external means.

The Use of Salt

The use of salt in small quantities placed in the mouth of the retort or in the inner end of the condenser, for the purpose of reducing the production of blue powder, has continued to be practiced by the Central Zinc Co., at Seaton-Carew, England; and has been tried also at the smelting works at Cockle Creek, New South Wales. From both places come reports of successful results, the production of spelter as direct metal being considerably increased and the production of blue powder being materially decreased. The salt is used in extremely small quantities as compared with the total charge of the retort. This, of course, is a different thing from the admixture of a small amount of salt with the charge, which has long been practiced. The beneficial effect of the salt at Seaton-Carew and at Cockle Creek is supposed to be due to the action of the salt vapor in removing the thin film of oxide coating minute pellicles of condensing zinc, thus allowing them to coalesce and to form fluid zinc.

Igneous Concentration

A good deal of attention has been given to the igneous concentration of zinc, i.e., the burning it out of the ore and collecting the fume. Of course, this is just what is done in the old Wetherill process of making zinc oxide, but in that process the production of an oxide of proper color is an essential condition. As a mere matter of concentration, the color of the oxide is quite immaterial. The concentration of zinc in this way has long been practiced by the New Jersey Zinc Co. in Virginia, the impure oxides being passed on to the spelter furnaces for reduction.

The development of the Pape process for the extraction of zinc from the Oker slag drew renewed attention to processes of this kind. Heretofore, Mr. Pape has been able only to treat slag, but I am informed that during 1912 he succeeded in adapting his process to the direct treatment of ore. Mr. Blum, in a small plant in Mexico, has experimented with an adaptation of the Huntington-Heberlein process for the same purpose. His work had previously been described in the Journal. Wilhelm Witter, of Hamburg, Germany, has pursued a somewhat different line, aiming to drive off the zinc in a reverberatory furnace. A large furnace for this purpose was erected in 1912 at the Binsfeld-Hammerhütte, at Stolberg, where a lead slag containing 8 to 10% zinc was to be treated. I have not yet heard respecting the result.

Edward Dedolph several years ago made experiments at the Blue Bell mine, in British Columbia, with a revolving cylinder for the burning off of the zinc of raw blende. I understand that his experiments have been repeated by the Metallurgische Gesellschaft, of Frankfurt-am-Main. Anyway, during 1912 that company acquired the rights to Mr. Dedolph's patents. The interest in the igneous concentration of zinc is stimulated by the desire to obtain an enriched and relatively pure product for electric smelting, of which I shall speak later on in this review.

Electric Smelting

A good deal of experimental work in electric smelting was done during 1912, among others by Specketer, Thierry, Cote & Pierron, Johnson and Petersen; and by the Vieille Montagne company and the Canadian Department of Mines. At Trollhattan and Sarpsborg, in Scandinavia, electrothermic spelter was produced commercially, and enlargement of the works was undertaken. The results in the smelting of 537 metric tons of ore in 1911 were reported by F. W. Harbord. According to him the average power consumption per ton of ore was 2078 kw., this relatively high figure being explained to a large extent by the necessity for resmelting two tons of blue powder for each ton of new ore. Some of the conditions entering into electric zinc smelting were outlined in a paper presented by myself to the Canadian Mining Institute, at Toronto, in March, 1912 (reprinted in the Engineering and Mining Journal of July 6, 1912). In this paper I indicated that the avoidance of blue powder to be resmelted is a necessary condition in making electric zinc smelting a commercially successful process; that the formation of the excessive proportion of blue powder, commonly experienced, was due to impurities in the gas and vapor, including an unpermissible percentage of carbon dioxide; and that the reduction of the power consumption to 1200 kw. per ton of ore would be a brilliant achievement.

I have been informed that Specketer, Thierry and Johnson have succeeded in avoiding an excessive condensation as blue powder, finding purity of the gas and vapor to be an essential condition, and although I am unable to verify these statements and this conclusion from personal observation and experimentation, both of the latter on my own part have prepared me to accept their probable truth. I am informed also of some well progressed experimental work wherein the smelting of ore containing 40 to 42% zinc has been done with a power consumption of only 1175 to 1200 kw.

In the United States, W. McA. Johnson, who has been engaged on this problem for seven or eight years, is certainly further ahead than anybody else. He has informed me of the production at Hartford, Conn., of several hundred pounds of spelter per day in campaigns lasting several days, and during 1912 has made perhaps a dozen tons of spelter in the aggregate. The Butte & Superior Copper Co. did some experimentation with the Petersen furnace, with more or less promising results, and toward the end of the year was contemplating a 10-day run at the rate of 2000 lb. of ore per day. The New Jersey Zinc Co. inaugurated some experimental work in its laboratory at Palmerton, Penn.

In Europe, electrothermic spelter was produced at Trollhattan and Sarpsborg, to which places I have previously referred. Some tonnage was also produced at Hohenlohehütte, Silesia, by the Imbert Process Co., but reports of what has actually been accomplished are still conflicting. The Imbert Process Co. has never given out anything about its operations. My private advices from Kattowitz are to the effect that after a great deal of costly experimentation, the process has been practically dropped at Hohenlohehütte. It has also been dropped by the Amalgamated Zinc Co., of Australia, which was looking into it. The Vieille Montagne company experimented with an electric furnace at one of its smelteries. Cote & Pierron also resumed experimental work.

The experimentation in electric smelting is following two distinct lines: (1) The smelting of mixed ores, drawing off the gangue in the form of slag from the distillation furnace itself; (2) burning off the zinc in a separate furnace, collecting it as fume, and subjecting the fume only to distillation in the electric furnace, the idea being that there are fewer complications with a relatively pure and high-grade product. The relative merits of these two ideas have not yet been worked out. In short the whole subject is still in its infancy.

Hydrometallurgical Processes

Hydrometallurgical processes fall under two heads: (1) Chemical and (2) electro-metallurgical. Processes of both types are on record as having been in commercial use, but nothing of either type has survived in regular practice. However, new proposals come by the scores and hundreds. Among the latest that have received attention, nothing much appears to have been accomplished with the widely advertised "bisulphite" process. The French process figured extensively in the newspapers, especially in British Columbia, in 1912, but tests of it that were made at Trail do not appear to have aroused any enthusiasm. Mr. Bretherton, in California, has been working upon his ammonia-zinc process, and is getting ready to make a trial of it upon a commercial, or semi-commercial, scale; his primary product is zinc oxide.

Mr. Keating, at Bully Hill, has been working upon the hydrometallurgical extraction of zinc and electrical precipitation of the metal from the solution. In an experimental plant of pretty good size, he has succeeded in rendering from 50 to 60% of the zinc of his ore soluble in water, by roasting very slowly at about 700° C. This is the best sulphating roasting that I ever heard of. Mr. Keating has succeeded in overcoming the main difficulties of electrolysis and has exhibited dense and compact cathodes of high purity and marvellously good appearance. The commercial prospects of this process are, however, still uncertain. At the Raritan Copper Works, Perth Amboy, N. J., experimental work with the Isherwood process was done during 1912. This is an offshoot, or a variation, of a process developed by Siemens & Halske, who also have succeeded in overcoming the electrolytic difficulty.

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Stamp Milling in 1912

By Louis D. Huntoon*

No radical changes were made in stamp-mill practice in 1912. The stamps installed in the new mills on the Rand still have for their prime object the crushing of large tonnages of ore in one operation. Apron plates were discarded and stationary plates following the tube mills were installed. This practice has not been introduced into North America. In Porcupine, Ont., apron plates were installed in the Hollinger mill, and both apron and tube-mill plates in the Dome mill.

Hand Picking

H. F. Marriott is responsible for the introduction on the Rand of a preliminary discarding of waste rock from the mine ore by hand. The first mine to adopt this method was the Village Main Reef. The annual report published in 1912 states that 16% of waste was discarded from 568,000 tons of ore. At the Robinson Deep, 15% was discarded from 698,521 tons of ore. Hand picking was introduced into all of the new mills erected on the Rand. At the Benoni mill, provision was made to give the ore a preliminary washing and to size it into three products before hand dressing, namely: Over 4 in., between 4 and 2 in., and under 2 in. The waste discarded amounts to 18.5%. The pebbles for tube-milling are selected from the ore over 4 in. size.

In America the advantage of preliminary hand dressing is fully realized in Nevada, but apparently no consideration has been given to it in Ontario. At the West End mill, Tonopah, Nev., provision was made to wash the ore before hand dressing, following the practice of other mills in that district. At Porcupine, Ont., no provision was made to discard waste by hand.

Crushing

All of the large mills erected in 1912 to treat gold ores installed stamps for crushing purposes. South Africa still leads the world in the use of heavy stamps. The Benoni mill started operations with 55 stamps weighing 2200 lb. The daily capacity of these stamps is reported to be 14 tons through 8, and 22 tons through 3 mesh.

In America the maximum weight has not reached that of South Africa although the tendency in new installations is to increase the weights above that in common use. The New York & Honduras Rosario Co. recently installed some stamps weighing 1800 lb., and the five-stamp mill of the Candor Mining Co. in North Carolina contains stamps weighing 1750 lb. These appear to be the maximum weights used in America. Bids have been taken by the Cinco Minas Co., state of Jalisco, Mexico, for 1600-lb. stamps. The Hollinger and Dome mills of Porcupine, Ont., contain 40 stamps, each weighing respectively 1500 and 1250 lb. The Tonopah-Belmont and Montana-Tonopah, two of the largest and oldest mills in Nevada contain stamps weighing 1050 lb. The tendency in Nevada was to increase this weight as evidenced by the following installations: West End Mill, 10 stamps weighing 1200 lb. and 10 stamps weighing 1300 lb.; Nevada Hills, 1250 lb.; Nevada Wonder,

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1400 lb. Heavy stamps are also used at the MacNamara mill in Tonopah. It is reported that 1550-lb. stamps are to be installed in the Commonwealth mill at Pearce, Ariz., and 1250-lb. stamps in the Bishop Creek Milling Co. at Bishop Creek, California.

Stage crushing has been advocated in South Africa for several years, but no large comparative tests have been made to determine the advisability of making this change. James A. Yule, in his presidential address to the South African Institute of Engineers, strongly recommended the replacement of stamps by rolls, and suggested that the mining companies contribute to a common fund to be used by the Mines Trial Committee to experiment along these lines. The advantages claimed by Mr. Yule are: Reduction in consumption of water, lower capital cost, and lower costs for attendance, power, labor and repairs. The Porcupine Gold Mines Co. (Vipond), Porcupine, Ont., appears to be the only company that replaced stamps with other machines for crushing ores during the year. At this property the ore passes through breakers, rolls, Hardinge conical mill, and classifier; the oversize is returned, the undersize goes to a second Hardinge mill in tandem, and the slimes to plates. The product from the second conical mill contains 95% under 100 mesh. The recovery is reported to be 85 per cent.

At the mill of the Tonopah Mining Co., five Huntington mills have been replaced by two chilean mills to take the product from the stamp battery. This change reduced the grinding costs from 16.9c. to 11.7c., thereby saving 5.2c. per ton, or a total of $9000 for the year.

Pneumatic vs. Gravity Stamp

The results obtained in April at the Mountain Queen and Yuanmi mines in Western Australia indicate that the Holman pneumatic stamp has a much greater crushing capacity than gravity stamps for the same cost of installation. The Mountain Queen, the first mine to install a set of double No. 1 Holman pneumatic stamps in Western Australia, started to crush ore early in 1912 with a total capacity, on fairly hard ore, of 135 to 160 tons per day through 10 mesh, or 67 to 80 tons per stamp. The capacity of the two stamps is stated to equal that of fifteen 1250-lb. gravity stamps. The speed of the stamp is much greater than that which can be obtained with gravity stamps. The report further states that the cost of repairs is the same as with gravity stamps. The installation at the Yuanmi mine consists of breakers followed by 20 Fraser & Chalmers 1250-lb. stamps. Following is a comparison of the two mills:

PNEUMATIC VS. GRAVITY STAMP

	Mountain Queen pneumatic	Yuanmi gravity
Stamps installed	2–No. 1 Holman	20–1250=lb.
Drop	12-in.	7½ in.
Speed, r.p.m.	125 to 135	103
Battery screen, mesh	10x10	10x10
Tons crushed, per month	3735	4280
Tons crushed per stamp, per day	67-80	8

The starting of the first tube mills on the Rand for pulverizing occurred at the Glen Deep mine, in May, 1904. The ratio of tube mills to stamps for one or two years following that date was one tube mill per 100 stamps. This ratio has gradually increased until the present practice of one tube mill for every 10 to 20 stamps has been reached. The Benoni mill, which started operations in 1912 contains four tube mills and fifty-five 2200-lb. stamps.

The character of feed to the tube mills has been investigated, with the following results: The crushing efficiency can be increased about 25% by the addition of sufficient coarse material to the feed, together with the fines, to permit the coarse material to travel almost to the discharge end of the tube mill. To accomplish this result at the West End mill, of Tonopah, 10 stamps crush through 10 mesh and 10 stamps through 6 mesh.

Amalgamation

In the new mills erected on the Rand, apron plates were omitted and stationary tube-mill plates installed. The area of the tube-mill plates has been greatly reduced, without decreasing their efficiency. In America, apron plates were installed, and at the Dome mine, both apron and tube-mill plates. The advantage of amalgamating after pulverizing in the tube mills is well illustrated by the recoveries obtained at the Robinson Deep mine, where both apron plates and tube-mill plates are in use. The percentage of total recovery is as follows: From battery plates, 47%; from tube-mill plates, 23%; total by amalgamation, 70%; and recovery by cyaniding, 30%.

Experiments conducted on the Rand recently, to determine the amount of gold absorbed by copper plates, in plate amalgamation, tend to prove that the gold does not penetrate into the interior of the plate and that practically all of it can be recovered by proper scaling. Following are the results from experiments conducted on 328 sq.ft. of plates which had been in use for 12 years: Recovery by steaming, 318 oz.; first scaling, 2¼ oz.; assay of plates after second scaling, 1.16 oz. A microscopic examination of the plates indicated that the absorption was due to amalgam penetrating microscopic crevices and blow holes in the structure of the plates.

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Review of Cyanidation in 1912

By Philip Argall*

There is a steady advance all over the world in the application of cyanidation to the direct treatment of ores, but we have no brilliant discoveries to chronicle either metallurgical or mechanical. It is being recognized more and more that each type of ore mixture should be a study in itself as regards separation of the minerals before or after cyanidation; the best method of preparing the ore for the dual process of concentration and cyanidation; and the advisibility of treating the concentrate on the ground or selling it to the smelters. All these points require the most careful consideration backed by a series of well conducted experiments before one can safely conclude he has the best solution of any given ore treatment. It follows, that the more thoroughly the preliminary work is done, the more rapid and certain is the success.

In simple ores, often called straight cyaniding ore, of which the Rand is the most noted type, there is no par-

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ticular progress to note. Tube milling is now well established and with the increased quantity of slime, vacuum filters have rapidly gained a footing in the field where three years ago decantation was universal.

Disappearance of Chlorination

Colorado metallurgy was noteworthy in 1912 for two things, viz., the ultimate conquest of cyanidation over chlorination, and the trying out of the Clancy process. With the failure of the stamp mills and plate amalgamation, also pan amalgamation, to save the mustard gold in the oxidized ores, following the discovery of the Cripple Creek, cyanidation and chlorination were introduced in custom mills at Cripple Creek in 1893. Cyanidation easily led on the oxidized ores, but the sulpho-tellurides came early, roasting was introduced as a preliminary to cyanidation in 1895 and with both processes, roasting, the race became more nearly even. The so called mill trust, formed by advocates of the chlorination process in 1901, obtained control of the largest cyanide plant in the State, and four years later cyanidation was apparently down and out. It was only sleeping, however. Some of us had firm convictions that cyanidation was the best process for the treatment of Cripple Creek ores, and with the construction of the Golden Cycle mill in 1907, these convictions were verified. The largest chlorination plant in Colorado closed down in January, 1912, while a few months later the last mill treating Cripple Creek ores by chlorination (the Portland) changed over to the cyanide process, thus bringing to a close the war of processes, waged with varying results over a period of 18 years, finally leaving cyanidation in undisputed possession of the field.

The Clancy Process

The Clancy process attracted much attention to Colorado last year because of the extensive notices and discussions in the technical press and the fact that the Ajax mill was built to exploit it. This mill started operations toward the close of 1911, bearing the seal of the inventor's approval, inasmuch as Mr. Clancy pronounced the plant perfect and added: "It will work, get the values and prove to the world that the Clancy process has revolutionized the metallurgy of the telluride ores of Cripple Creek[1]."

The first official statement I have seen regarding the Ajax Mill, was published in the *Cripple Creek Times,* over the signature of Judge Colburn, in reply to the widely advertised results from this mill. He said: While expressing satisfaction with the showing made up to that time, the claims as to extraction and profits made in the Ajax Mill are erroneous; the statement, that ore was being treated for 75c. per ton and $2 ore treated at a profit were unwarranted at that time, Jan. 15, 1912.

A. W. Warwick, who had charge of the metallurgical operations, writing in the Transactions of the American Metallurgical Society, March, 1912, enumerates changes made in the Clancy process and intimates "that when the mill settles down to steady work, the extraction will leave less than $1 per ton in the tailings, and the consumption of chemicals will amount to about 12c. per ton and the cost of treatment will be $1.50 per ton.

Shortly after this, the mill closed down for various changes, chiefly I believe to rectify the wretched design of the sampling department and has but recently resumed work. Mr. Warwick's figures, had they been realized, are neither original nor remarkable, inasmuch as others are obtaining better results without the Clancy process; hence that process falls far short of revolutionizing "the metallurgy of the telluride ores of Cripple Creek."

The basic claim of the Clancy process is that it will break up the sulpho-telluride combination and give a high gold extraction from the unroasted and unconcentrated ore (raw ore). Concentration tests made on tailings from the Ajax mill show that a concentrate ranging, in several tests, from 1½ oz. to 2 oz. of gold per ton is easily collected. This result does not quite support the statement that the sulpho-tellurides will yield a high extraction by the Clancy process; however, it is but fair to state that Mr. Clancy has not had charge of the milling operations and should not be held entirely responsible for the work of others, who openly claim to have modified his process. It is reported that Mr. Clancy will shortly assume personal charge of the Ajax mill and I hope his most sanguine expectation may be realized. The process is an interesting one, there is room for such a chemical process and we welcome any improvement in the reduction of the rebellious sulpho-tellurides, even as an addition to concentration.

Cripple Creek Practice

The successful low-grade mills in the Cripple Creek district pursue the even tenor of their way, crushing and concentrating in cyanide solution, treating 50 to 60% of the ore by pneumatic agitation and oxidizing chemicals and rejecting the sands with or without previous leaching in tanks. Fine-grinding expenses are thus less than half that required in an "all sliming" process like Clancy's. The concentrate produced in milling is sold to the smelters, who pay 10c. per unit for its iron content in excess of the silica. Concentration is the key note of low-grade sulpho-telluride milling at Cripple Creek, improvements and enlargements are the order of the day and every effort is made to obtain the highest possible recovery in a sulpho-telluride concentrate. Concentration has undoubtedly come to stay, in the treatment of the low-grade sulpho-telluride ores of Cripple Creek.

Preparation of the ore for cyanidation has not undergone much change during the two years since my last review. Stamps, chilean mills, rolls, ball mills, tubes and pans all have their advocates. The 2000-lb. cam-operated stamp brought its own trouble and cannot by any means be called popular; chilean mills are advancing in popularity as are also rolls; ball mills are successful in dry crushing, and of little account in wet work, because of the heavy abrasion of balls, plates and particularly screens. Tube mills are the most popular of all fine-grinding machines; there is a tendency however toward shorter tubes, particularly in concentration mills.

Concentration

Concentration on the whole does not appear to receive the full attention it deserves as a medium in reducing costs and increasing extraction in the cyanidation of mixed ores. Its antipode is "all sliming" which, except for silver ores, cannot be said to have made any advance. The contrasting points in these methods might be summed up as follows:

[1]"Cripple Creek Times," Sept. 26, 1911.

Concentration: Medium grinding, removal of a small portion of deleterious material—usually carrying the bulk of the gold—for special treatment, thus shortening the agitation or leaching period and reducing the consumption of power and of chemicals.

All sliming: Usually a lower extraction, increased cost of finer grinding and prolonged agitation; the whole pulp must be agitated till the most rebellious particles reach the maximum extraction.

Classifiers

Classifiers of the helical and drag types are now used in practically all modern cyanide plants. They make but two products, slime and sand, the best of them furnishing without water or additional fluid a slime that surpasses any work screens can produce. In one works where 97% of the slime was required to pass 0.002 in. aperture and the helical classifiers, were adjusted accordingly, a run of 65,000 tons covering a period of six months gave a slime that varied but 0.5% coarser or finer than 97% passing 0.002 in. screen aperture (200 mesh). Cones or other hydraulic classifiers with their diluting streams cannot give these results, so it is not surprising that the mechanically operated helical classifiers are finding their way into concentrating mills for the primary slime separation, thus closely following cyanide practice. They are also used for unwatering concentrates and tailings where the water must be used over again; in tube milling, however, they are indispensable in obtaining the best result. The discharge from the tube mill is led directly to a classifier, slime of the desired fineness immediately escapes to the next process, while the deslimed sand is returned to the feed end of the mill, where the correct quantity of water to obtain the highest tube mill efficiency is added. Thus a sliming cycle of the highest efficiency and of absolute uniformity of product is established, the helical classifier acting at once as a slime separator, subject to adjustment, of product; and as a feeder to the tube mill, delivering sands of uniform water content.

Agitation and Filtration

Agitation is steadily settling down to the Pohlé air lift; the tall slim Pachuca has probably run its course. With practically maximum weight of metal for a given capacity, some of us could not see the utility of its expensive awkwardness. Bernard McDonald has gone back to first principles, flat-bottom tanks, using pneumatic agitation efficiently.

Filtration: Vacuum filters are not spreading as I expected two years ago; pressure filters are slowly coming to the front, decantation is being revived, and in modified form, with newer devices, may yet hold the field for both cost of operation and efficiency in removing soluble gold.

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Analysis of Cyanide Practice

By Herbert A. Megraw

The advances made in cyanidation during 1912 were of the nature of a slow and steady development rather than any sudden and startling advance. There were no revolutionary processes suggested and the offering of new machinery was meager. A tendency toward the improvement of some of the older measures has been evidenced, an opinion that some of these are capable of such improvement that they may compete with the newer methods, having gained considerable ground.

In South Africa the development was along lines already instituted in former years, the increasing weight of stamps having apparently reached the maximum and begun to recede toward a more conservative standard. In America much new work in plant construction was undertaken, but political conditions in Mexico were responsible for much delay and the actual abandonment of some new mills that had been planned. With the increasing price of silver a period of rapid expansion should have taken place in that country, and would have if normal conditions had been maintained, or even had there been a fair prospect of their return.

Return of the Chilean Mill

One of the significant developments of 1912 was the favor with which the chilean mill has been regarded. It is being recognized that this machine has much merit and in many cases can be profitably used to replace stamps. The work of high-speed mills in Cripple Creek and other camps has been such as to justify their use and has proved that it is possible to adjust them so as to produce a pulp of the desired character. The chilean mill fell from favor during the days when plate amalgamation was at its height and later when cyanidation was first applied and leaching was the only approved method. At that time it was claimed that chilean mills produced an abnormal quantity of slime which was then distinctly undesirable. Later when it became possible to treat slime economically, this objection was partly removed, and still later when the practice of total sliming became popular the objection disappeared, but so much time had elapsed since the machines had been used, and a new generation of metallurgists unacquainted with its merits having appeared, the chilean mill still remained in the background. Fortunately, however, some of the old type mills remained in older installations and served as a germ which has lately grown to something like power.

Where a granular output with little slime is desired, as in mills where classified concentration is to be followed, the high-speed mill with coarse screens can be used with economy and if finer particles are required for subsequent treatment, regrinding can be resorted to. The Independence mill and the Portland mill at Cripple Creek are instances of successful application of these mills in serving such purposes.

Slow Speed Mill for Slime Product

In such installations where the object is to reduce the ore to a slime as quickly as possible and with the least expense, the old slow-speed mill with a track of large

diameter and large, heavy rollers has proved its economy. The new and modern mill of the Angustias company, which was built at Pozas, Guanajuato, during 1912 includes four of these old type mills which are calculated to reduce 200 tons per day from 1-in. cubes to a product of which from 60 to 70% will pass a 200-mesh screen. An expenditure of about 60 hp. is required. These mills include the device known as the Mantey offset which induces a tendency to drag the roller over the die in addition to making use of the usual crushing feature by the simple rolling of the heavy wheel over the bed of ore on the die.

The advantage of machines of this type is beginning to be well recognized, as is evidenced by the article by J. B. Empson[1]. It is probable that future calculations for crushing and grinding machinery will take more notice of the slow-speed chilean mill, especially in smaller installations where regrinding is to be avoided as much as possible. In the larger plants rolls are coming to be more used, delivering a product of appropriate size for regrinding either in tube mills or high-speed chilean mills.

Rolls Proposed for Larger Plants

Rolls are being more and more considered for use in the larger installations. These machines, if manipulated by careful and experienced workmen, are considered capable of reducing rough ore to sizes appropriate for regrinding machines at a cost far lower than that obtained by stamps. Their use is on the increase and it would not be surprising to see them displace stamps in many instances. Rolls have been considered expensive when used on extremely hard ores but it is doubtful if this objection is well founded. The extremely hard rock now being successfully broken by rolls at the Victoria mill in the Black Hills is a good indication that they are able to perform the work. Rolls are largely used in Cripple Creek also and these ores are by no means soft, although they are not so hard and tough as those above mentioned. The critical point in roll operation seems to be in proper feeding to avoid corrugation of the shells. When this is satisfactorily done the expense is low.

The question of tube-mill lining is still unsettled. A great many mills are still using the lining of silex brick, claiming that they have found nothing more economical. Others get more satisfaction from the El Oro lining or some one of its modifications. Experiments are being made with the type of lining known as the Komata, which is a plain, hard iron lining with ribs or shelves with the object of lifting the pebbles and allowing them to drop upon other pebbles and the pulp, crushing by impact.

Type of Agitators Changing

The question of agitation received a great deal of study during 1912 and as yet there has been no unanimous decision in favor of any type. The Pachuca seems doomed to be relegated to the rear, the general opinion being that it offers no advantages in extraction nor economies in operation, its installation expense being decidedly against its use. It has been claimed that the old mechanical agitation is just as satisfactory and as economical in operation, and the first cost is a great deal less. The Parral system has received some study and in some cases has been called unsatisfactory and in others has been a success. It seems to me that a tank to make use of this process ought to be properly proportioned. With a tank which is extremely deep it is too much to expect that the rotary motion imparted to the surface of the pulp will be carried to the bottom of the tank and still be strong enough to prevent settling. And also in tanks of great surface area the number of lift pipes ought to be sufficient to give satisfactory rotary motion and not leave large areas without means of agitation. A central lift, not reaching the surface, might improve results in tanks of large diameter. It is probable that if these requirements are observed the system will give good results.

Other agitation systems do not seem to be making much advance. The Dorr agitator is a new claimant for honors and the coming year will be likely to see a decision on its usefulness. One does not hear much of the hydraulic systems and the many other permutations and combinations which have been devised in order to be different.

Continuous Agitation Not Universal

Continuous agitation has made forward strides, but it is not yet so perfect as to be universally adopted. Some of the newer installations are planned for using the charge system, and many of the older ones built for that practice have not found sufficient inducement to change to continuous treatment. The main difficulty seems to be that no continuous system has yet been suggested in which there is not a possibility of short circuiting some portion of the ore and thus losing in efficiency. In continuous systems the examination of a tank interior is denied the operator, and he is always more or less in the dark as to what is going on and whether settlement and building up within the tank is taking place. In order to be sure that the character of outflow from a tank is the same as the inflow considerable experimentation is necessary, otherwise it may be found that the lighter portion of the pulp is being short-circuited through the tanks system and the heavy portion, the sand and granular concentrate, is building up, with results which are not admissible. The charge system certainly requires more attention and probably a greater expense per unit of ore handled, but some operators consider it more certain and therefore more satisfactory.

Another point which is claimed for the charge system is that definite changes of solution may be made whenever they are considered advisable, while with continuous systems it is difficult to do so. There are methods whereby agitation and decantation may take place in the same tank and at the same time, fresh solution being run in to take the place of that decanted, but one cannot be absolutely sure that there is an actual and sharp change of solution in such practice, and in fact diffusion is unavoidable. These schemes have not yet attained any great degree of success.

Separate Treatment for Sand and Slime

Separate treatment is again being brought to the fore, it being considered more economical in some cases to leach the sand rather than reduce it to a point where it

[1]Eng. and Min. Journ., Feb. 3, 1912.

can be agitated. The cost of the regrinding is said to more than overbalance the additional metal recovered by so doing. There are undoubtedly instances where this is true. During the first grinding a certain amount of the ore is slimed and it is often the case that the slime contains the greater part of the desired metal. Of course the contrary is true sometimes, but instances of this condition are rare, and it is more usual to find the slime richer. Naturally when the sand contains very little value it is not advisable to spend much money on its further treatment, and it is often true that by giving it a superficial treatment with cyanide solution the maximum economy may be obtained. This is the case at the mill of the Dominion Reduction Co. at Cobalt, where the sand is separated in a classifier, washed with cyanide solution and discarded. It is also true at the mill of Stratton's Independence, Ltd., at Cripple Creek, where the sand contains little of value and is treated by leaching in flat bottomed tanks and sluiced out. There may be other cases where the making of a total slime is difficult and expensive and it would be found more economical to grind to a certain point, making slime and fine sand, treating the slime by agitation and separating the sand and leaching it. Of course this depends entirely upon the nature of the ore and every problem must be solved on its own merits. It is probable that leaching of sand will become once more an important part of the cyanidation of certain ores. It is just as well, however, to remember that the handling of sand is accompanied by difficulties that cost money to overcome. And this is especially true where water is scarce and tanks have to be discharged by hand labor. In such cases it is not improbable that the handling of sand may cost more than regrinding it and handling it as slime, and where any advantage in extraction is shown the ultimate result may be more satisfactory.

Use of Zinc Dust Increasing

The use of zinc dust as a precipitant for precious metals in cyanide solutions is increasing as was to be expected. The advantages presented are many and it is probable that in time it will altogether supplant the use of zinc shavings. Some users of the method have been said to find difficulty in securing barren solutions, where gold is the metal to be recovered, and that it is almost impossible to obtain solutions low enough in value to be used as wash for slime cakes. In fact, the zinc-dust method was discarded in one instance for that reason, but it seems likely that the same difficulty would be found when using zinc shavings. The circumstance is not to be taken as of general occurence, but is probably due to some local conditions. It is naturally easier to get a comparatively barren solution, low enough in value to be used as wash, when silver is the principal content, but with gold the actual amount of metal in solution must be far lower in order that its value may be negligible. To secure this condition the only remedy seems to be to use a greater proportion of zinc and to give somewhat more time of contact.

A variation of zinc-dust precipitation was described by Whitman Symmes[2], and consists in preparing a bed of zinc dust on a filter in the bottom of a tank, through which bed the solution is drawn. This provides an excess of zinc at the beginning of the operation, but the proportion of the precipitant decreases as the amount of pregnant solution being drawn through it, and it seems likely that at the end of the operation, unless calculations are extremely exact, there would be a decrease in efficiency. It is claimed that the method is more efficient and economical, but that seems to require some substantiating data.

The process is now being used in connection with filter presses other than the Merrill triangular frame press, which was especially designed for it, but the latter has an advantage in that the precipitate and zinc are kept constantly agitated, avoiding the loss of zinc by having it covered up with precipitate. An innovation which has lately been tried is having the solution discharge of the press at the top instead of the bottom of the frame, the idea being that in case of unavoidable stoppage of the plant the frames could be kept full of solution, avoiding oxidation of the zinc.

Filter Question Still Unsettled

The matter of filters for slime tailing seems to be still in the development stage. Nobody has yet decided which one of them is the best for general purposes. The manufacturers seem to be about the only ones with any definite ideas on the subject. There are numbers of new ones still taking their way through the patent office and it is a poor year indeed that does not bring forth a few new machines. Most of them are simply variations, however, and all of them are based on the principle of the original device.

The recent court decision seems to have brought panic to many manufacturers and users, but the chances are that they will be none the worse for it, the users at any rate. The decision ought to have the effect of stimulating endeavor toward something really new; something that will do more than ring the changes on an original invention.

A great many metallurgists are making efforts to get away from the use of any filter at all, their hope being in a development of continuous decantation and thickening. There are several important mills now making a trial of the scheme and the results will be awaited with considerable interest. The process seems applicable in places where water is not scarce and where weak solutions can be used. Where water is scarce and costly and strong solutions must be used, as with silver ores, some form of dewatering machine will be required in order to reduce water and cyanide consumption to lowest terms.

The Merrill slime press is about the only one that operates on a distinctive principle, and it has achieved considerable success in regions of abundant water and particularly where a heavy, granular material is to be washed. In such regions as at Porcupine it is probably at its best.

Concentrate Separately Treated

The separate treatment of concentrate is a matter that has received a good deal of study during the year. It has been the recipient of a great deal of experiment in recent years and is still being developed. It seems likely that where a portion of the ore is rebellious and requires

[2]"The Mexican Mine, Virginia City, Nev." Eng. and Min. Journ., Oct. 12, 1912.

more time and stronger solution to give up its contained metal, it would be the wiser course to separate it and give it special treatment, thus allowing the main bulk of ore to be handled in a shorter time and by less expensive methods. This has actually been done in several cases during the last year and in others experiments are still being carried on with that end in view.

Electro-cyanide methods have received some study, and work is still being carried on, but at the present time there have been no results which can be called decisively advantageous. Electrolysis of solutions has promised advantages and in a few cases has complied, but as yet it can be called little more than a promise.

Chemical improvements have been comparatively scarce for the past few years and it is in this department that more knowledge is needed. Rebellious ores can hardly be conquered by merely mechanical means and there is a large amount of mineral that is not susceptible to known methods of cyanidation. The copper, zinc and lead bearing ores have been outside the sphere of cyanide influence, but it seems that there ought to be some means of bringing them within the fold. Of course this refers to ores containing these metals in small quantities aside from their content of gold or silver or both. Chemical improvement is needed and it is not at all unlikely that it will come in the near future.

Gold Dredging in 1912

By Robert E. Cranston*

In looking back at the dredging industry in 1912, there seems to have been little advance either in methods or in the number of new dredges put in commission. The old fields, Feather River, Yuba River and American River districts, continue to hold first place and no new areas were developed which can compare with these in extent.

Several New Dredges in California

Among the new dredges which were built in California and elsewhere is the Oro Vista, built for Lawrence Gardella, near Oroville, which has the distinction of being the first new dredge to be built during 1912 and is also the last dredge contracted for by the Risdon Iron Works before it was absorbed by the Union Iron Works. The Oro Vista has 5-cu.ft. buckets, and will dig 35 to 42 ft. below the water line and 12 ft. above. It is equipped with a revolving screen, belt conveyor, standard gold-saving tables and uses 200 hp. The hull is 108x42x8 ft. The bucket base and hood are cast of manganese in one piece. The lower tumbler is six-sided, the upper tumbler, five-sided. The bucket line is driven by a single 12-ft. gear. The conveyor is 103 ft. long.

The Union Dredging Co. completed its 9-cu.ft. dredge on the Blue Ravine channel, near Folsom. The Natomas company constructed a new 15-cu.ft. steel-hull dredge for Rebel Hill. This dredge is known as Natomas No. 10. The Gaylord Mining Co. reconstructed the old Eldorado 6-cu.ft. Risdon dredge which formerly operated near Fair Oaks and is now in operation on the American River near Auburn. The Calaveras Dredging Co. has installed a rebuilt 5-cu.ft. dredge at Jenny Lind on the Calaveras River. Near Trinity Center, on the Trinity River, the Alta Bert Co. reconstructed the old Scott River dredge to handle 3000 cu.yd. per day.

The Yuba Consolidated Co. has dug the pit and has under construction a new steel-hull boat to be known as 1-A. The dredge will be similar to No. 13, except that it will have a steel hull. The buckets have a capacity of 15 cu.ft. The Natomas company is reconstructing its Nos. 7 and 8 dredges with steel hulls. Natoma No. 6 will be similarly rebuilt.

Increased Use of Steel Hulls

There is a decided tendency toward building dredges for permanent work with steel hulls. It took a long time for dredge engineers to make up their minds to use the steel hull, but I believe there is no question as to the advisability of so doing when the life of the property to be dredged warrants the extra expense.

Two dredges are operating in Placer and Eldorado Counties, Calif., one at Cache Rock and the other near Loomis in Secret Ravine. In Siskiyou County one clam-shell, one orange-peel and one California-type dredge are now operating. The clam-shell is operating at McConnell Bar, on the Klamath River. The machinery was built by the Wellman-Seaver-Morgan Co. This machine is said to handle about 1200 yd. per day. The bedrock is cleaned by hand and supposed to be rich. The ground in this district was previously worked with varied success by hydraulic methods, steam shovel, "China" pump, hydraulic elevator, etc. The orange-peel is operating at Hamburg Bar, on the Klamath River. This machine has a Hayward bucket and is steam driven; it uses a suction pump and diving apparatus in connection with its gold-saving apparatus. The California-type dredge has 5½-cu.ft. buckets, was built by the Boston Machine Shop Co. and operates on McAdams Creek.

A dry-land dredge is being operated on the American River, near Copley. In Southern California there are two dredges operating on the Calaveras, one at La Grange, one at Comanche and two near Snelling, on the Merced River. On Butte Creek two companies are operating, each with a dredge.

A Modern Dredge in Georgia

L. M. Richards built a modern California-type dredge on the Chestalee River, near the Dahlonega district, Georgia. This is, I think, the first modern dredge built in Georgia. The ground in this vicinity has been worked before by steam shovels, by sluicing and by hand methods. This dredge has 3-cu.ft. buckets, shaking screen, belt conveyor, standard gold-saving tables, electric drive, etc. The ground to be handled has a heavy overburden of red clay and there is, in the gravel, about 1% of black sand which runs from $3 to $6 per ton. Some success was reported in past years in handling this sand, but the figures given do not appear to me to indicate the possibility of much profit.

At Breckenridge, Colo., the Reliance, Colorado and French Gulch companies started work early in the sea-

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son and expected to take out about $1,000,000 this year. The most noteworthy work in Montana is the four large dredges of the Conrey Placer Mining Co., which operates on about eight miles of Alder Gulch. The dredges of this company have been steady producers for some time. The Boston & Idaho Co. has two dredges operating steadily near Idaho City, Boise County, Idaho. The Sprague Co., Ltd., is operating a small dredge near Pierce, Clearwater County, Idaho. The Castle Creek Dredging Co. continued to operate its dredge at Mystic, S. D., but the production was probably less than in 1911.

A new dredge was built by the Powder River Gold Dredging Co., on Powder River, Sumpter County, Ore. The Trinity Dredging Co. has a new dredge which is working ground above Lewiston, on the Trinity River. I have no description of this dredge so do not know what type it is.

Eight or ten new dredges were installed in Alaska, four of which were built by the Union Construction Co. for installation as follows: One 3-cu.ft. dredge for the Pasadena Gold Dredging, operating on Budd Creek, Port Clarence district; one 3-cu.ft. dredge for the Inmachuck Dredging Co., on Inmachuck River, Fairhaven district; one 2¾-cu.ft. dredge for Ruby Dredging Co., on Casadepoga River, Solomon district; one 1¾-cu.ft. dredge for Candle Creek Dredging Co., on Candle Creek, Candle Creek district. Several dredges were also installed in Canada, among which were two 16-cu.ft. Marion dredges built for the Canadian-Klondike Mining Co., now Boyle Concessions, Ltd. In fact, there was more new building outside of the United States proper than inside. There was a determined search for small tracts suitable for using up old dredges. This search was disappointing, only a few small areas being developed.

Few disasters were reported in 1912, but several of the dredges which were burned or sunk during 1911 were rebuilt and are now in operation. Among these may be mentioned El Oro No. 1 and Pacific No. 1, at Oroville, the Calaveras Gold Dredging Co.'s dredge on Jenny Lind and Natomas No. 8. The first three were sunk and the latter burned. Yuba No. 10 was also burned but has so far not been replaced.

A Peculiar Installation in California

Most prominent among the freaks of the year is the installation of the Tarr Mining Co. which only needs to be described in order to be classified. The plant is as follows: The gravel is hydraulicked into a sump and is then elevated in a standard line of 7-cu.ft. buckets into a revolving screen having ½-in. holes. The coarse material is taken by a belt conveyor, in two sections, and dumped into two Bleichert tramways which convey the boulders into adjacent ravines; the fines go over standard gold-saving tables, then through a tunnel; whence they are elevated into a second revolving screen with finer holes, the coarse being sent to a dump and the fines to Overstrom tables, where the black sand, said to carry platinum and other valuable minerals, is saved.

A concrete dam is to be used to create a settling basin in order not to discharge tailings into the Yuba River. The buckets, revolving screen, gold-saving tables and conveyors are of the standard-dredge type, but are installed as a stationary plant. So far as I can see about all this elaborate equipment does is to get rid of the boulders. The saving of valuable minerals out of the gravel by means of concentrating tables is, of course, absurd in view of the results of exhaustive experiments along these lines in California.

Of course, this apparatus will never be able to work successfully, but I think it possible that some of the vast areas of low-grade gravel in this vicinity may at some future time be handled by mechanical means. They were formerly worked at a profit by hydraulic methods and I think it within the bounds of possibility that a method could be developed which would give a small margin of profit. The volume of gravel within the watershed of the Yuba River is large and it would seem worth while spending a little time and money to work up a process which would be practical.

Good Results from Large-scale Operations

Some surprising results have been obtained in the economical handling of large quantities of material; for instance, it is reported that one of the large dredges built by the Yuba Construction Co. handled during one month 320,000 cu.yd. of material at a cost of less than two cents. This is perfectly possible and I have no doubt is a correct report. This brings to my mind another matter in regard to dredge costs. Real dredge costs cannot be figured over less periods than five years. Many of us have run dredges for several months with surprisingly large production and small costs. The first two years' run of a newly built dredge will give much lower results than the first five years. The maximum size gold dredge now has a bucket holding 15 or 16 cu.ft. and the results from these large dredges have been most satisfactory. It would seem that, if we had areas to warrant, much larger dredges would soon become the rule.

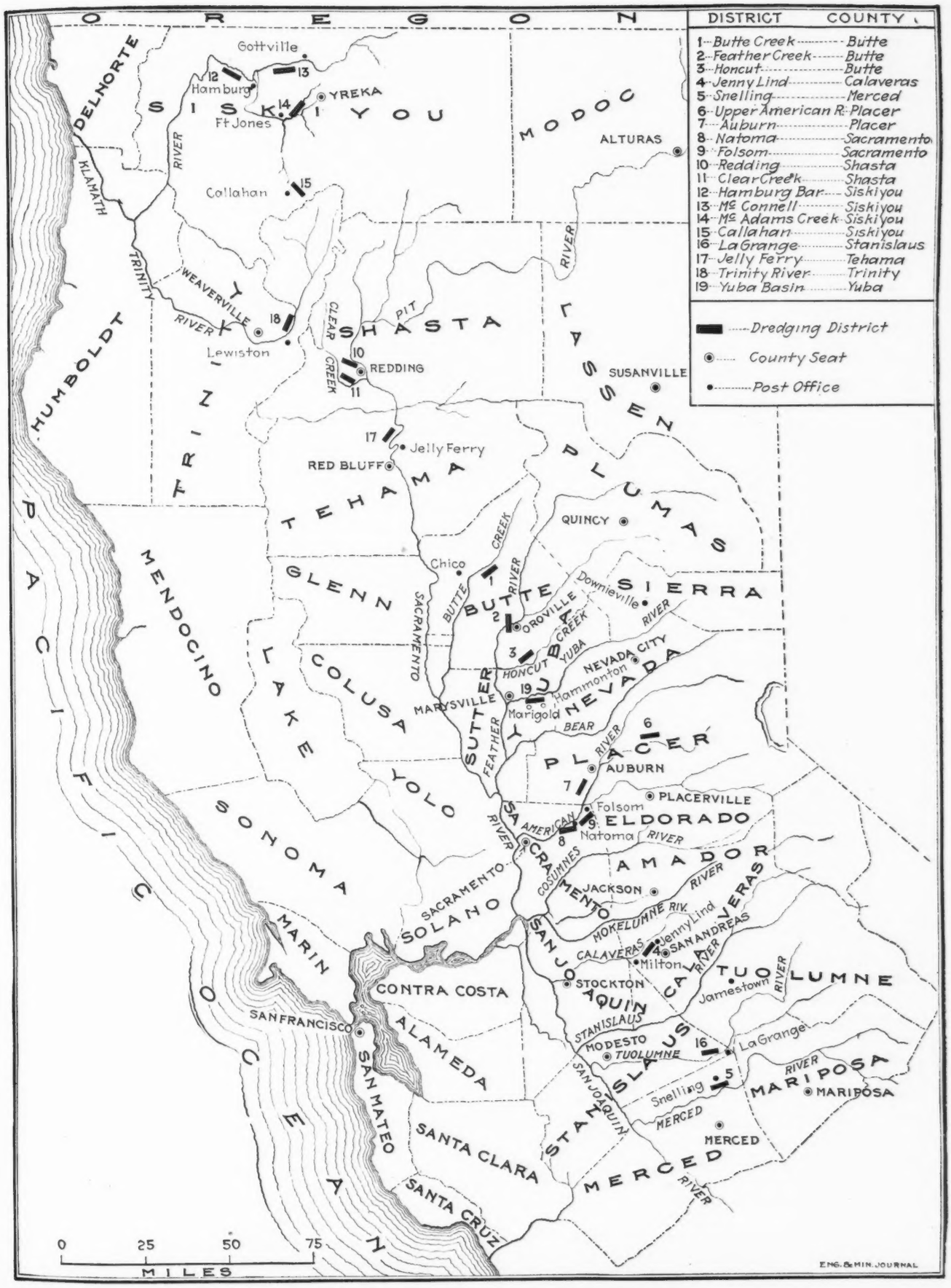
The "Corozal," operating at the Panama Canal, has 52-cu.ft. buckets and has a capacity of 1200 cu.yd. per hr. Another point of interest which I have noticed was the work of the U. S. Harbor and River dredges. The reports show costs as low as 1¾c. per cu.yd. and the average for the year was $5\frac{4}{10}$c. for hopper dredges and 7.18c. for pipeline dredges.

Sampling Method Affects Reported Results

After 14 years of testing gravel for dredging the best method of sampling these areas is still more or less uncertain. We in California have used the Keystone drill for this purpose and have more extensive data than anyone else as to the recovery. On the basis ordinarily used by dredge engineers 75 to 80% recovery is considered about right, but we hear repeated statements giving much lower recoveries as well as higher; for instance, one company reports a 72% saving in handling 3,500,000 cu.yd. of 16c. ground; another has results as low as 40%, while I was told by one operator the other day that anything under 90% was considered by them as poor work. In other words, the results vary from 40 to 90%. As a matter of fact I do not believe that the actual results are as far apart as this. The difference comes in the sampling itself, that is, in the method of figuring gold content from drill holes.

New Dredging Fields Needed

Ten years ago it looked as though the possibility of gold dredging in the United States was almost unlimited. Now I think we may safely say that the large areas of good dredging ground have been taken up and are being worked



GOLD-DREDGING DISTRICTS OF CALIFORNIA

out. Many small areas will be developed as time goes on, but I am of the opinion that if we wish to go into the gold-dredging business on a large scale, it will be necessary to search outside of the United States for this purpose. Canada, Alaska, Siberia, Africa and South America have not been thoroughly gone over and I think some good areas will be developed in these outside districts, and I hope for the sake of the industry that such will be the case. It would seem a pity that 14 years' of experience and development should be thrown away, for unless some new districts are discovered the dredging industry will gradually disappear.

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Aluminum in 1912

There was no substantial increase in the production of aluminum during 1912, nor any substantial change in the general manufacturing conditions. Aluminum is produced by an electro-chemical process, and its cheap production, therefore, is dependent upon the development of large and cheap water powers. The Aluminum Co. of America, which is at present the only producer of aluminum in the United States, failed to get authorization from Congress to develop its water-power proposition which would be in operation now had the authorization been granted when requested. It is to be hoped not only for the benefit of the aluminum industry, but for all electro-chemical industries that the time will soon come when Congress will adopt some reasonable plan by which the various water powers that await development for use in electro-chemical and electro-metallurgical work may be rendered available. The Aluminum Co. of America is, however, pushing ahead with its new water-power development in Tennessee, for which the necessary authorization had been granted prior to its acquisition by that company, and it will not be long before a large increase in its productive capacity may be expected. In the meantime competition has arisen in the Southern Aluminium Co., which has purchased the nearly completed water-power development at Whitney on the Yadkin River in North Carolina, and has begun the erection of a plant with a capacity for about 5000 tons of aluminum per annum. Work is being pushed rapidly on this plant, and the Southern Aluminium Co. will probably be producing aluminum by the middle or end of 1913.

In England and on the Continent, the same condition prevails as in the United States. Water powers which require legislation by governments are being so surrounded by red tape that a long time is required to acquire rights. Several of the foreign companies have, however, obtained possession of water powers for which authorization has either already been granted, or which require no authorization, and substantial increases in output may be expected in 1913 and 1914, although there was no change of any moment in the European output of 1912 as compared with the output of 1911.

There was, however, a marked increase in the consumption of aluminum in 1912, both in the United States and abroad. The same activity that characterized the steel and copper industries during the last six months of 1912 appeared also in the aluminum business. At the beginning of 1912 there was a large stock of aluminum, both in this country and in Europe, but that stock is now exhausted and the demand is now straining the productive capacity. However, the demand slackened considerably during December, and the outlook is for a easy market during 1913 as soon as the unfilled orders have been cleaned off the slate.

The market condition of 1912 resulted in a slight stiffening of the price in the United States, but the Aluminum Co. of America pursued its usual policy of maintaining a uniform price, notwithstanding that the demand warranted an increase. Its price for aluminum for the last quarter of the year was about 21c. per lb, an advance of about 1c. over the price prevailing during the first quarter. The prices on imported aluminum, however, showed a considerable increase. It is understood that the large international metal houses, foreseeing the situation, contracted for a large percentage of the European output for the last six months of 1912, and this aluminum was later offered to consumers in this country and abroad at rates 5c. or 6c. per lb. in advance of the rates in effect at the beginning of 1912. Comparatively little metal, however, has been sold to these brokers for 1913. While the scarcity of metal in Europe will probably continue for some little time to come, it is not expected that the manufacturers themselves will demand as high prices as the brokers have been demanding during the last few months.

No radically new use for aluminum developed during 1912. The Aluminum Co. of America put on the market an electrical conductor composed of seven wires, the center wire being steel of high tensile strength. This cable gives great promise of supplying for long-distance transmisson work a conductor that is both light and strong. The Pacific Light & Power Co., at Los Angeles, Calif., adopted this steel and aluminum cable for its new transmission line. The Pacific Light & Power Co. is making a noteworthy development—noteworthy not only for the amount of electrical energy, but also for the distance to which it is to be transmitted. The power station is 275 miles from Los Angeles, so that this line is the longest of its size in the world. The fact that after very careful investigation this company adopted the use of the steel-aluminum cable naturally gives the aluminum manufacturers hope that this form of cable will be successful for electrical transmission. A new use for aluminum is the manufacture of foil, which is being used as a wrapper by candy and tobacco manufacturers, instead of tin foil.

The importation of foreign aluminum into the United States increased greatly in 1912, owing to the conditions previously outlined in this article. In 1911 the total importation was 4,173,308 lb. In the first 10 months of 1912 it was 15,213,258 lb., but 211,036 lb. were reexported. The average monthly price for aluminum, as quoted for the open market, was as follows:

AVERAGE MONTHLY PRICE OF INGOT ALUMINUM
(At New York, in cents per pound)

Year	1911	1912	Year	1911	1912
Jan.	20.13	19.13	July	20.20	23.50
Feb.	21.25	19.44	Aug.	20.02	24.38
Mar.	21.15	19.58	Sept.	19.34	25.13
April	20.75	20.38	Oct.	18.75	26.25
May	20.55	21.69	Nov.	18.79	26.56
June	20.03	22.83	Dec.	18.85	25.75
			Year	20.067	22.01

The above quotations are indicative of the transactions in the open market, especially as made by dealers in foreign aluminum. The actual average price of all the aluminum sold in the United States was somewhat less, the Aluminum Co. of America having placed its contract business at the fixed price of 20@21c. per lb.

Mining in California in 1912

By Lewis H. Eddy

The value of the gold produced in California in 1912 was approximately $20,000,000, a decrease of about $300,000 from 1911. The production of silver in 1912 was about 1,300,000 oz., of an average value of 61c., or a total of $793,000, a decrease in quantity, but an increase in value. Lead is estimated at 1,200,000 lb., of an average value of 4½c., or a total of $54,000.

The decrease in gold, silver and copper was due largely to the continued suspension of the Balaklala smeltery, which was closed in July, 1911, and remained closed throughout 1912. Other causes contributing to the decrease in the gold production were a slight shortage of water and the temporary closing of some of the large mines on account of accidents which hindered ore extraction and closed down the mills. Another contributory cause was the special attention given to exploration and development. In some of the mines of the Mother Lode this was due to the necessity for finding new orebodies; in others, production was sacrificed to development. The decrease in copper and silver was further due to experiments in progress at the Campo Seco smeltery, where the thiogen process was being applied to the reduction of sulphur dioxide. The farmers in the copper-mining regions continued their war on the smelteries, and were also particularly active against the Selby plant. In the latter part of the year the farmers in the southern part of Sacramento County instituted proceedings against some of the Mother Lode mines, on account of the dumping of tailings.

Mother Lode Operations

A large amount of mine development, surface improvement, and new installation was in progress during the year. Some of this work was a continuation of that begun in 1911, but a large proportion of it was begun in 1912. Development included the exploring of new orebodies in the producing mines, the reopening of old mines, the deepening of shafts and the advancing of tunnels. Improvements included new stamp mills, cyanide plants, hoisting machinery, compressors, pumps, mineaphones, power drills and the substitution of electric for steam power. In the Mother Lode region, progress extended to all the counties, but was particularly active in Amador and Tuolumne.

In Amador County, the main vertical shaft at the Kennedy was deepened to 3700 ft., and will be continued to 4000 ft. New orebodies were encountered above the lowest working level. The Argonaut prepared for the deepening of its inclined shaft to 4000 ft. The Central Eureka encountered a new orebody in the 2800-ft. level. The Oneida was purchased during the year by the South Eureka Mining Co. New ore was disclosed below the 1500-ft. level in the Zeila. The reopening of the Lincoln and Wildman-Mahoney by the Lincoln Consolidated advanced into Wildman ground, where an 9-ft. vein was encountered on the 1950-ft. level, 400 ft. below the old Wildman workings. The Pacific shaft of the Plymouth Consolidated was unwatered and pay ore was discovered in the lower levels. The Keystone shaft was unwatered, cleaned and repaired, and deepened to 2000 ft. The Hardenburg new vertical shaft was sunk to 1070 ft., and the orebody cut by a 220-ft. drift. Improvements in Amador County during the year included a new 20-stamp mill at the East Eureka; new hoisting machinery and gallows frame and the beginning of a new 20-stamp mill at Hardenburg; new steel gallows frame at the Bunker Hill; new hoist at the South Jackson; new gallows frame, hoists and pumps at the Plymouth; new compressors and pumps at the Fremont and the South Amador.

In Tuolumne County the important new installations were: A 75-ton cyanide plant at the Black Oak; a new 20-stamp unit added to the 20-stamp mill, and a new electric hoist at the Dutch Consolidated. New orebodies were disclosed in the Dutch, the Harvard, Eagle-Shawmut and the App. The App was closed and the mine sold under mortgage in December. The important mines reopened were the Clio, Mammoth, Tarantula, Jumper, Atlas; and some smaller mines at Tuttletown.

In Calaveras County, the Angels mine was the only large one operated steadily during the year. The Utica was closed temporarily on account of shortage of water; the Gold Cliff had two interruptions on account of accidents in the shaft; the Dolling discontinued extraction and milling for a part of the year, but continued development and opened a new large orebody and prepared for the installation of an underground electric hoist; 10 new stamps were added to the 30-stamp mill early in the year. The Melones installed a new electric hoist, after having encountered a new vein of high-grade ore. Some old mines were reopened and there was new development in various districts in the county, including the Waterman, at Angels Camp; the Ingomar, at Campo Seco, and the Calaveras copper mine, at Copperopolis. At the last named mine, auto trucks were installed for hauling ore to the railroad; some high-grade copper ore was shipped.

In the last half of 1912, much development was done in the Forbestown district, in Butte County. The Gold Bank was reopened; a new shaft was sunk at the Burlington mines, and a number of new and old properties were put in working order. There was also a good deal of activity in the Magalia district.

Activity in Nevada County

New installations in Nevada County included a 100-ton cyanide plant at the Pennsylvania, a duplicate of the plant installed at the Empire in 1911; an electric hoist and pump at the Sultana; an electric hoist at the Golden Point; a complete electric plant at the Artic; about one mile of the 5-mile flume under construction by the Delhi mine was completed. Development at the Champion mine, operated by the North Star Mines Co., was successfully advanced; 20 stamps were placed in commission, and preparations were made for the installation of a cyanide plant. In some of the districts in Sierra County there was a scarcity of water, but in general the county was prosperous. Siskiyou County made some advance in quartz mining.

In Shasta County, the Mammoth copper mine and smeltery operated throughout 1912; development was advanced and new orebodies encountered. The iron mines and the electric smeltery at Heroult were operated, and

the plant was partially remodeled. Experiments in the treatment of the zinc ore were made at the Bully Hill with some promise of success. Gold mining, in Shasta County, was greatly retarded by the closing of Balaklala smeltery. The Midas mine, at Harrison Gulch, and the Gladstone, at French Gulch, showed substantial progress during the year, and preparations were made for the installation of a cyanide plant at the Midas.

The lead-silver mines in Inyo County are reported to have produced an amount approximately equal to the product of 1911. Several new installations were reported to be in contemplation in Inyo County, but the only one finished was a 10-stamp mill at the Bishop Creek mines.

Trinity County advanced in quartz mining and also in the opening of new dredge placers. The Alta Bert and the Trinity Dredging Co. had a successful season. The Craig Mining Co., at Dedrick, began the installation of a 40-stamp mill.

New gold discoveries were made in Willow Creek district, Humboldt County. The mines in the Hoag (High-grade) district, Modoc County, produced some high-grade ore, but the scheduled boom failed to hold investors. Development gave promise of a few good mines.

Gold mining in the Randsburg district, in Kern County, progressed materially in 1912. The King Solomon, the Butte, the Consolidated Mines and the Yellow Aster were the important producers. At the close of the year there was a prospect of securing electric power. The Placer Gold Co. installed a new plant for extracting gold and tungsten from gravel.

New discoveries of tungsten were reported near White's Camp, seven miles northwest of Randsburg. The mines and mill at Atolia operated in 1912, and increased the production of tungsten; 100 men were employed.

Potash deposits were reported at China, Borax Lake and Salt Wells, 28 miles north of Randsburg.

Construction of the Saline Valley Salt Co. plant, in Inyo County, was nearing completion at the close of the year. The Natural Soda Products Co. completed its vat system and pumping station near Keeler. The Foreign Mine Development Co. introduced auto trucks for hauling its soda product from Borax Lake to Searles, on the Nevada & California Railroad.

The production of borax came chiefly from the mines in Death Valley and from Kern and Ventura Counties. The Russell Borate Co. was arranging late in the year for animal teams to haul the product from its mines in Ventura County to Bakersfield, a distance of 59 miles. The total production in the state is reported to have increased.

The principal supply of magnesite in California still comes from Tulare County. The demand in 1912 was greater than the supply and there was some importation from Germany.

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Metal Mining in Colorado in 1912

By George E. Collins *

The year 1912 was again comparatively uneventful in Colorado, but as a whole fairly prosperous. As is well known, the state contains few mines of the first rank, but a large number of small producers operated by privately controlled companies and by lessees. Many of these are doing well; and the actual profits earned last year were larger than usual. In particular, the increased price of silver is a great boon, although practically no mines are operated solely for the silver value, and the increase is not sufficient to encourage the reopening of idle properties.

Gold and Silver

The completion of the Roosevelt drainage adit led to the gradual unwatering of a large part of the Cripple Creek district at the rate of several inches daily. By the end of the year the El Paso, Portland and other important mines were drained to the bottom. An important discovery of sulphide ore in the 1600-ft. level of the Portland mine affords hope for an indefinite continuance of productiveness. The recognized success of the drainage adit has led to the discussion of various schemes for still deeper drainage, either by lower adits, or a central pumping station.

The hopes of improvement in Cripple Creek metallurgy, which were based on the Clancy process at the Ajax Mill, were not sustained by results, and the mill is being remodeled with a view to return to more nearly standard practice. At the Portland and Stratton's Independence mills good results are being realized in the treatment of low-grade and dump ores. The last year witnessed the closing down of the United States Reduction & Refining Co.'s Colorado City plant, and with it the final supremacy of cyanidation in competition with chlorination.

In Gilpin and Clear Creek Counties there were no new developments of importance; the output continues relatively small. With the exception of the Gunnell, none of the larger mines along the line of the Newhouse Tunnel is as yet unwatered by seepage through cracks in the country; the work of unwatering by laterals to strike the known watercourses, or by actual connection with the present deep workings, made little progress during the year. A diamond-drill hole was, however, driven from the tunnel level and connected with the workings of the Kansas-Burroughs mine; the latter is thereby being unwatered at the rate of two feet per day.

In the San Juan district Telluride is by far the most active center, thanks to the activity of its three great mines, the Liberty Bell, Tomboy and Smuggler-Union. The Camp Bird, by a lucky discovery in the nick of time, has prolonged its life for a year or more.

At Silverton the three largest mines, the Silver Lake, Gold King and Iowa-Tiger, are being worked only in a small way by lessees. The Sunnyside continues to handle a large tonnage, but is increasingly dependent on the base-metal contents of its ores.

At Aspen the bold attempt to unwater through the Free Silver shaft and reopen the deep levels for further prospecting was retarded by labor troubles and other difficulties. At Creede the plans for exploring the great Amethyst vein in depth through a central shaft are slow-

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ly taking concrete form, and a shaft below the adit level was commenced. Meantime important discoveries are being made in a parallel vein. Elsewhere in Colorado no important new developments are recorded.

The lead and zinc production is reviewed in the departments devoted to these metals.

Placer mining around Breckenridge is fairly active, but the rest of the state has no similar deposits in course of exploration. The Twin Lakes placer near Granite, in the central part of the state, definitely suspended operation, as a result of legal proceedings brought on behalf of the towns further down the Arkansas River. Gold was discovered in recent conglomerate beds near Denver; in the opinion of some, there is a possibility of the deposits proving extensive and economically important.

There was no marked change in the copper output of the state. Copper is in the main a byproduct from gold and silver ores, although in a few cases an exceedingly important one. The output being scattered and comparatively small, the ore must necessarily be sold to lead smelteries under rather disadvantageous conditions. The only producing properties which can be properly classed as copper mines are in the San Juan district, notably the Indiana, and the Congress at Red Mountain; for the treatment of these ores the pyritic smelting works at Quary is being remodeled and placed in operation.

Rarer Metals

The mining and treatment of tungsten ore in Boulder County, and of vanadiferous sandstone at Placerville in San Miguel, are now permanently established industries. In the former case especially the pockety nature of the individual orebodies, and the fluctuating market for the product, have combined to render the output excessively variable from year to year. In this respect 1912 may be said to have taken an intermediate position, and the price for tungsten concentrate having been recently raised, the outlook for 1913 is highly favorable. A little uranium was produced contained in carnotite-impregnated sandstone from the Paradox Valley. Some pitchblende was mined in Gilpin County, where it occurs as small lenticular bodies in gold-bearing veins on both flanks of Quartz Hill. None of the many localities where tungsten ores have been found outside of Boulder County has proved steadily productive so far.

Labor Conditions and Legislation

The gradual improvement in the efficiency of labor, which has been noted for the last three or four years, has continued. With the exception of Aspen, where there was a short-lived strike of merely local significance, no labor disturbances occurred during the year.

At the election held in November, a number of proposed constitutional amendments were carried by referendum, among which were two separate and distinct eight-hour measures, one applying to all classes of labor in mines and smelteries without distinction, and the other only to labor which is employed under conditions detrimental to health. Precisely what will be the legal effect of this vote is somewhat uncertain. An ill-considered amendment constituting all mills and smelteries public utilities, whether handling custom ores or not, and evidently intended to enable the legislature to regulate smelting-treatment rates, was supposed to have carried, but according to the official declaration was defeated. Any hasty and ill-considered action of this kind is sure to react on the mining industry, which in Colorado at least, is unable to bear further burdens.

The Mining Industry in Montana

By F. L. Fisher*

The copper-producing companies that operated in the Butte district in 1912 were the Anaconda, North Butte, East Butte, Tuolumne, Butte-Alex Scott, Davis-Daly, Elm Orlu, and, toward the latter part of the year, the Bullwhacker. With the rise in the price of copper the output of all of the companies was gradually increased and in the case of the East Butte and Tuolumne, a marked increase in production over former years was established.

The electrification of the Butte, Anaconda & Pacific Ry., between Butte and Anaconda, was begun, but a strike caused a temporary suspension of the work. An extension to this road was constructed from Anaconda to the Georgetown district, in which the Anaconda company acquired the Southern Cross mine late in 1911. As a result of this extension, mining was resumed at many old properties at Georgetown, and a number of new ones were opened.

Three-year Labor Agreement

In July, a three-year contract was made by the Anaconda company and the Butte Miners' Union for a daily wage increase of 25c., while copper sells between 15 and 17c., and 25c. additional when the price is 17c. or over.

The Anaconda company began the reconstruction of portions of the Boston & Montana smeltery at Great Falls. The largest converter ever constructed was placed in commission in August, effecting considerable saving in treatment costs. The converter is 20 ft. in diameter, 8 ft. larger than the others in use, and handles about 50 tons of matte at one heat.

Anaconda Mining Operations

At the Mountain View mine, electric motors were installed and considerable development work done. The air shaft of the Pennsylvania mine was retimbered and enlarged from the 1400-ft. level to the surface. The main shaft was advanced, three compartments wide, from the 1800-ft. level to a depth of 2060 ft. The mine was closed down for six weeks late in the summer to change the hoisting power from steam to compressed air.

Leonard No. 2 shaft, the main hoisting outlet, was sunk from the 1800- to the 2200-ft. level. The change to compressed-air hoisting caused a shut-down of about six weeks early in the summer. The shaft of the West Colusa mine was sunk from the 1800- to the 2000-ft. level; and the mine connected with the Mountain View

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workings on the 1200-ft. level by a drift from the latter property. The East Colusa mine, one of the smallest of the company's properties, was operated continuously, hoisting between 200 and 300 tons of ore daily. The Tramway mine was closed for air-hoist installation during the greater part of May and June, since which time it has been operated steadily. The Rarus and Minnie Healy mines were operated entirely through the Tramway shaft. At the Silver Bow mine about 6000 tons of ore were hoisted monthly. An electric pump was installed on the 1000-ft. level and about 240 gal. of mine water per minute were pumped to the surface and run through precipitating tanks, saving about 0.1% copper. The shaft of the East Gray Rock mine was abandoned, and the mine operated through the West Gray Rock. A complete surface plant was established at the latter property.

The East Butte produced about 1,200,000 lb. of fine copper per month. It is planned to enlarge the blast furnaces to twice their present capacity. The sintering plant placed in operation and made an important saving in handling the flue dust.

Development work was carried on at the Speculator mine of the North Butte company, opening orebodies in both the Edith May and the Jessie veins. The Gem shaft was sunk from the 1800- to the 2000-ft. level. At the Tuolumne mine, operations were begun with the new Nordberg hoist early in the year. In August, an arrangement was made with the Anaconda company for the treatment of second-class ore from this property, of which large bodies had been developed, but left unmined for the lack of economical treatment facilities. About 50 tons of first-class, and 100 tons of second-class ore were subsequently shipped daily to the Washoe smeltery.

An injunction in the suit between the Anaconda company and the Butte & Ballaklava company prevented work in the disputed territory of the latter company, and operations were confined to sinking the shaft from the 1400- to the 1600-ft. level, and in mining a small amount of ore in veins not connected with the suit.

A large amount of development was done at the Ophir mine of the Butte Central Copper Co., and occasional shipments of silver ore were made. A contract for the erection of a 200-ton mill was awarded to the Colorado Iron Works. The building was completed in November and the installation of the machinery started.

At the Boston & Corbin property, in the Corbin-Wickes District, a good vein of copper ore was developed and several carloads shipped for testing purposes. The erection of a new headframe and a 250-ton mill, at an approximate cost of $100,000, was begun late in the year.

Zinc Activity at Butte

The discovery of large bodie s of zinc ore in the Black Rock mine of the Butte & Superior company, and of a successful method of treating it, resulted in the acquisition of much new territory by existing companies, and the formation of others for the development of claims in the northeastern Butte district. Early in 1912 construction was begun upon a 1000-ton mill at the property of the Butte & Superior company, and early in the summer a portion of the plant was operated on zinc ore hoisted through the Black Rock shaft, the concentrates being smelted at Bartlesville, Okla. Development on the lower levels of the mine blocked out large tonnages of high-grade ore. The company acquired control of the properties of the North Butte Extension and the Butte-Milwaukee companies, adjoining the Butte & Superior holdings on the east and north, respectively, and in addition a number of independent claims in the vicinity.

W. A. Clark, owner of the Elm Orlu mine, adjoining the Butte & Superior on the west, began the erection of a zinc concentrator on the north side of Timber Butte late in 1912. He constructed a spur from the mill to the Butte, Anaconda & Pacific Ry. Shallow wells were sunk on the flat below to obtain water for milling purposes.

Mining Boom at Georgetown

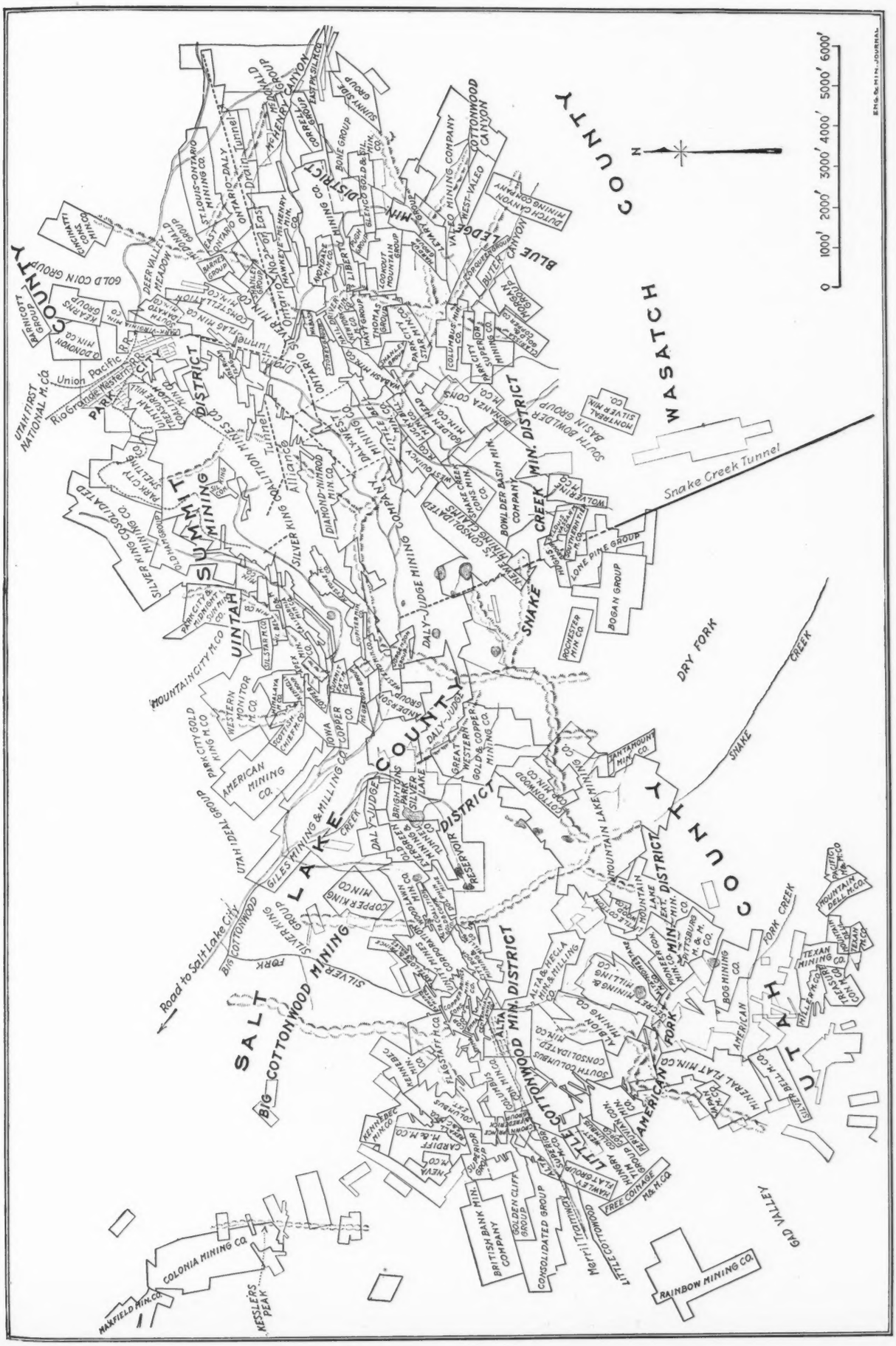
A mining boom in the Georgetown district, Deer Lodge County, followed the announcement that the Butte, Anaconda & Pacific Ry. would be extended from Anaconda to Georgetown. Anaconda men reorganized the Trilby Mining Co. and began development work. The Butte-Anaconda Mining Co. began operations on several quartz and placer claims, and the Hidden Lake property was operated by the owners. The Butte & Georgetown Mining and Milling Co. did considerable placer prospecting and operated a hydraulic outfit on a portion of the property. At the Georgetown Gold Mining Co. property, development work is under way. Work was carried on steadily at the Baltic Combination mine. At the Southern Cross mine of the Anaconda company a large amount of work was done in preparation for mining. At the Red Lion mine a quantity of low-grade ore was blocked out.

Construction was started on a branch of the Chicago, Milwaukee & Puget Sound Ry., from Three Forks into the Radersburg district in Broadwater County. Some ore was shipped from the Radersburg district, but most of the mines confined their work to development. Among the properties operated were the Keating, Ohio-Keating, Black Friday, Butte & Radersburg, and Bonati.

The Conrey Placer Co. operated four dredges at the mouth of Alder Gulch in Madison County, and purchased 80 acres of placer ground further up the gulch. This company now owns all but a small amount of the placer ground in Alder Gulch, from Alder to Nevada, a distance of eight miles. The New Mine group in the Rochester district was sold to San Francisco men, who incorporated as the Gold Coin Mining Co., and began construction of a mill.

Thomas Cruse, of Helena, operated the Bold Mountain and the Belmont mines, in the Marysville district, making regular shipments of high-grade ore to the mill at Marysville. The St. Louis Mining Co. carried on development work, and later in the year began the erection of a 100-ton mill.

The Barnes-King Development Co. acquired the property of the North Moccasin Mining Co., adjoining their property in the Kendall district, Fergus County, and also the Piegan-Gloster property in the Marysville district. The Snowshoe mine, in Lincoln County, was operated by the Montana Smelting Co., composed of California men. The ore was treated at the mill on the property, and the concentrates shipped to the East Helena smeltery. The Royal Basin Mining and Milling Co. operated a mine and mill near Flint in Granite County. A cyanide plant was erected at the property of the Granite Bimetallic Mining Co., near Philipsburg, for the treatment of tailings from the old mill.



PROPERTY MAP OF PARK CITY, COTTONWOOD AND AMERICAN FORK DISTRICTS, UTAH

Mining in Utah in 1912

By Edward R. Zalinski*

The first months of 1912 were marked in the mining industry of Utah by a steady and increasing production, but during the last quarter, operations at Bingham were curtailed by labor troubles. The tonnage for the year was not far from normal, but the output had a greater value, due to the increased prices of copper, silver and zinc. On the basis of returns available from Park City, Tintic, and Beaver County, it appears that the production of lead increased about 5,000,000 lb., as compared with 1911.

Gold Output Below Normal

The Consolidated Mercur was the chief producer of siliceous gold ore. The gold from low-grade copper ores increased up to the last quarter, but this failed to bring the gold production for 1912 up to normal. Silver showed a large increase over 1911. The zinc production was less than in 1911 on account of the suspension of operations by the Grasselli plant, which treated a large accumulation of zinc middlings. The production of copper was not greatly different from that of 1911, a slight increase being noted. The output from the porphyry mines at Bingham showed a steady increase during the first three quarters, but was later reduced to about half normal. During the first 10 months of 1912, the average daily output of the district was about 19,000 tons, based on the output of the Utah Copper, which averaged 16,002 tons per day, and an estimate of 3000 tons for the other mines of the district. On this basis the production for the first three quarters of the year was 5,206,000 tons. During the final quarter, the output of the Utah Copper was about half normal, while for the other mines it was not more than 25% of normal. This brings the total estimated production for 1912 to 6,208,800 tons, as against 6,570,000 tons in 1911.

There was an increased production of copper, lead, and siliceous silver ores from Tintic, and zinc ores began to receive attention in that camp. Stockton showed renewed activity with six shippers. The output from American Fork decreased. Production from the Cottonwoods increased, as did shipments from Beaver County. The Santaquin and Nebo districts in Utah and Juab Counties showed an increasing production; carbonate lead ores, lead-zinc, and clean zinc ores were shipped; the principal producers here were the Union Chief, Eva, and Eureka Leasing Company.

The Utah Ore Sampling Co. operated plants at Silver City and Murray. This company also acquired and operated the McIntosh sampler at Park City.

Smelting Operations

The United States Smelting, Refining & Mining Co., at Midvale, ran five lead furnaces in 1912. The American Smelting & Refining Co., at Murray, had four or five lead and one matte-concentration furnace in operation. This company stockpiled lead ores, a good proportion of which were sulphides. The roasting capacity was increased, and two Dwight-Lloyd sintering furnaces added. Early in May a strike of workmen on the charging floor and yards reduced operations for about a month. In June, five or six furnaces out of eight were in blast, and shipments received at the usual rate. The Garfield smeltery operated two blast furnaces and five reverberatories, smelting from 2000 to 2300 tons of ore and concentrates daily. Several of the reverberatory furnaces were satisfactorily equipped to burn California crude oil. The International, at Tooele, had three, and later four, reverberatories in blast, treating about 600 tons of copper ore daily. Two new lead furnaces were blown in early in the year. The sintering capacity was found to be inadequate, and four Dwight-Lloyd sintering furnaces were added. A large tonnage of lead ore was accumulated. Material for the third and fourth lead stacks was ordered in May; when these are erected, the lead smelting capacity will be 800 to 1000 tons per day.

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United States Smelting Co. Enters Coal Field

The United States Smelting, Refining & Mining Co. took control of the Consolidated Fuel company's coal lands on June 1, 1912. The holdings comprise about 7526 acres of bituminous-coal land in Emery County and a half interest in the Southern Utah R.R., which connects the mine with the Denver & Rio Grande at Price. A 90-mile line extending from Mohrland and connecting with the San Pedro, Los Angeles & Salt Lake Ry. at Provo will be built. This road, with the Southern Utah line, will furnish a direct outlet for the coal fields.

The remodeling of the Arthur mill of the Utah Copper Co. was completed, and coarse-crushing equipment added. The Magna plant treated about 70% of the ore at the first of the year, and the Arthur, 30%. During the third quarter the last sections of the Arthur mill were started, and this plant then handled 38% of the tonnage. Both mills have now been completely remodeled, except for minor improvements in the coarse-crushing department. Arrangements for hydro-electric power will probably be made, when enlargement of the Magna steam plant will become unnecessary.

The Bingham Strike

In April, miners employed underground in the Boston Consolidated mine of the Utah Copper Co. struck for an increase of 50c. per day. An increase of 25c. per day was granted by Bingham operators on Sept. 1. But this applied only to underground labor. The miners demanded a general increase of 25c. more, this increase to apply to surface labor as well. A strike was called by the Western Federation of Miners on Sept. 17, and all the mines, as well as the concentrators at Garfield, were closed. The operators were willing to discuss the question of wages with their own men, but refused to recognize the union. Operations were begun with strikebreakers early in October at the Utah Copper and Highland Boy, and the other properties resumed operations about the middle of October. The situation gradually improved, and working forces were increased. The strike has not been declared off, but has been broken, and work was carried on with reduced forces. Miners were scarce, as many men left the camp when the strike was called.

Silver, Lead and Zinc

The Silver King Coalition, Daly West, and Daly-Judge at Park City and the Centennial-Eureka in Tintic were the principal silver-lead producers in 1912. In addition to the lead produced by the Park City mines, lead ores were mined at Bingham by the Utah Apex, Bingham-New Haven, Bingham Mines and Utah Consolidated. Beaver County and the Santaquin district in Utah County added to the output.

During the last part of 1912, between 1500 and 2000 tons of zinc ore monthly was shipped from Tintic. A large part of this went to smelteries in the Middle West. A new freight rate of $7.30 per ton on $30 ore to the Kansas zinc smelteries, as compared to a former rate of $9.50, went into effect Sept. 16. The production from Park City by the Daly-Judge increased. The Daly West produced zinc concentrates. The Grasselli plant at Park City, and an auxiliary plant built to treat tailings along Poison Creek, did not operate. Numerous small tailings mills made occasional shipments of zinc concentrates. The Daly-Judge shipped zinc middlings to the Huff electrostatic plant of the United States Company at Midvale. This plant also treated other custom ore and ore from the company's own mines at Bingham.

Uranium and Vanadium

The principal producing uranium and vanadium districts are in Emery and Grand Counties near Green River, Thompsons, and Moab. Adjoining this section on the southeast is the Paradox Valley district in San Miguel and Montrose Counties, Colorado. The combined production of these Utah and Colorado fields in 1912 (exclusive of the straight vanadium ores mined at Newmire, Colo., which were treated on the ground) amounted to approximately 600 short tons, averaging 1.75% U_3O_8, and 5% V_2O_5. Fully half of this came from Utah, and was exported to Europe.

Utah ores are largely carnotite. There is an average wagon haul of 25 miles, costing about $8 per ton. Freight charges from shipping points to European markets are approximately $17 per ton. In addition, there are sampling, sacking, and assaying charges, which amount to $8 or $9 per ton more. Up to the present time, all of the high-grade shipments have come from small pockets and the richest available deposits have been largely exhausted in endeavoring to live up to the high minimum of 2 to 3% uranium oxide demanded by European manufacturers. The present tonnage can probably be continued, but the grade of the ores will be lower.

PARK CITY, TINTIC AND BEAVER COUNTY ORE SHIPMENTS IN 1912.

	Park City Tons	Tintic Tons	Beaver County Tons
Jan.	7,346	26,124	1,850
Feb.	9,442	34,890	2,900
Mar.	9,625	31,417	2,600
Apr.	7,159	29,554	2,500
May	7,908	31,427	2,300
June	7,182	32,234	2,840
July	7,572	22,079	3,770
Aug.	6,334	36,784	7,100
Sept.	6,518	28,651	6,700
Oct.	7,445	29,643	8,500
Nov.	7,653(a)	30,280(a)	4,106(a)
Dec.	7,653(a)	30,280(a)	4,106(a)
Total for 1912	91,837(b)	363,363(c)	49,272
Total for 1911	109,722	364,040	.....

(a) Shipments for November and December are estimated, but will be about the same as for the previous months, or slightly greater. The average of the first 10 months has been taken.
(b) Crude ore and concentrates.
(c) These shipments include iron ores amounting to 7000 tons.

Gold and Silver in Idaho in 1912

By Robert N. Bell *

The gold output of Idaho during 1912, amounting to 75,000 oz., recorded an increase principally by reason of a good water season throughout the state, permitting the steady operation of the dredging plants of the Boston-Idaho company at Idaho City, with a daily capacity of 12,000 cu.yd. of gravel, and of the new Kirtly Creek dredge near Salmon City, with a capacity of 6000 cu. yd. per day.

Several discoveries of gold ore were reported in the central part of the state, the most promising one being the Big Creek district in Idaho County. A transaction involving the advance payment of $5,000 on the Moscow mine is reported. The deposit is a shear zone of pyritic quartz in porphyry, careful sampling of which across its entire width of 150 ft. yields $3.00 per ton, at a maximum depth of 150 ft. This zone exhibits a length of several thousand feet. The gold yields readily to amalgamation and cyanide treatment. With its favorable natural facilities, the deposit should prove profitable if worked upon a sufficiently large scale.

The principal source of silver in Idaho is its lead ores, reviewed elsewhere in this issue, which carry a proportion of silver ranging from 1/8 to 1½ oz. per unit of lead. The treatment of copper ores, and the milling of siliceous gold-silver ores in Owyhee County also yield silver. The total silver output of Idaho for 1912 was about 8,500,000 oz. The Delamar mine, in Owyhee County, maintained its normal output of over 200,000 oz. per year, together with about $250,000 worth of gold bullion. The exhaustion of this property has been predicted annually for years, but it has been kept alive by judicious management, increased tonnage, and ingenious adaptation of treatment to gradually receding values. This property is owned by an English company which has lately been seriously harassed by special agents of the Interior Department, assessing claims for timber and fuel purchased from local woodmen for years past. Its cordwood, costing $12 to $14 per cord, consists largely of desert growth of juniper, "mahogany," and other brush wood, the bulk of which is packed on mule back from the surrounding desert mountain slopes. The material has no semblance to forest growth, and had no value as lumber. If the Government suits now pending against this company are successful, it will be put out of business, as the operation has shown a very narrow margin of profit for several years.

The Elias Myers Mines, in the same township as the Delamar, is a new silver venture recently acquired by a wealthy English investor of that name. It is now being developed under the direction of the engineering firm

*State mine inspector, Boise, Idaho.

of Bambridge-Seymour Co., of Salisbury House, London, England. A 16-drill compressor has been installed on the property, to be electrically driven by current from the Trade Dollar lines of the Oregon-Idaho Power Co., and a 40-stamp mill is in prospect during 1913. The company's claims cover a series of vertical fissures two miles in length; these veins vary from a few inches to 10 ft. in thickness. They contain gray copper and antimonial silver ore; present development at a depth of 500 ft. indicates from 10 to 50 oz. silver per ton and $1.50 in gold.

The base-metal production in Idaho is reviewed under the respective departments treating of these metals.

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Phosphate Deposits

The phosphate industry of southeastern Idaho continues to drag by reason of adverse freight rates and Federal withdrawals. The U. S. Geological Survey continued its study of this field in 1912 and has now outlined a resource of several billion tons of 70% phosphate rock occurring in well defined beds. If these deposits were opened to the public and a free hand given for their exploitation and development, as such a vast volume of mineral warrants, an important industry would doubtless be developed.

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Mining in New Mexico in 1912

Developments in the mining industry of New Mexico were characterized by a steady growth and general increase of production, in the last year, with the exception of the ores of zinc. Shipments of zinc-sulphide ore and concentrates remained about the same as for 1911, but the shipments of carbonate ores decreased.

While several discoveries of mineral deposits were announced at times during the year, no new camps of noteworthy promise were established. Progress is shown more in increased production from established camps. Copper mines were reopened at San Pedro, Santa Fé County, and at Hanover, in Grant County. Zinc deposits were reopened after having been idle for a year.

The production of gold and silver showed a small increase and lead and copper decided increases, particularly in the case of the red metal.

The increase in the copper output came chiefly from the operations of the Chino Copper Co., at Santa Rita. This ore is concentrated at Hurley, where a 5000-ton plant has been completed in five sections, two sections being in operation at the beginning of 1912 and the other three being successively placed in operation during 1912, the last being completed in December. The second copper district in importance was the Lordsburg district, with an increased output for 1912. The Burro Mountain district, where much development work has been done during the last six years, made a small output.

The lead output of New Mexico was chiefly from the shipments of lead ore and concentrates from the lead-zinc deposits at Kelly, Socorro County, but there were also increased shipments of lead ore from the Cooks district, Luna County. Zinc concentrates and ore were shipped from Kelly, and from Hanover and Pinos Altos, in Grant County.

Vanadium is one of the mineral products of the state and a deposit is owned by a Pittsburgh corporation, but the result of this company's operations is a matter of conjecture, as all information in regard to its properties is withheld.

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The Magdalena District

By A. Lawrence Heister

The Magdalena mining district and the camp of Kelly at the end of 1912 was in a more prosperous condition than ever before. The Tri-Bullion company operated its mines and mills, producing an increased quantity of lead and zinc. The N. I. T., Grand Tower and the old Kelly mines all showed good orebodies, and an uptodate 400-ton mill will no doubt be built by this company in 1913.

The Ozark Smelting & Mining Co. (Sherwin-Williams) is pushing work on its mill, which will be built of structural steel and concrete. A 360-hp. De La Vergne oil engine and a generator will furnish electric power for the entire plant. An aërial tram will supply the ore from the Waldo tunnel.

The Macdonald lease, operating on the Juanita mine, lately shipped four cars per week of high-grade zinc carbonates. A number of men are making good wages leasing in the upper workings or carbonate stopes of the Graphic mine. The Hardscrabble mine, a rich shipper of long ago, and idle for the last 10 years, will soon change hands and undergo systematic development. The Iron Mask is also expected to be systematically working in 1913.

A working day of 10 or 12 hr. became a matter of history in the Magdalena mining district. The 8-hr. schedule prevails in mines and mills throughout the camp. The change came without strikes or contentions of any kind, but from a mutual understanding between operators and their employees. It is encouraging to note that assessment work was done in a more substantial and honest manner than ever before.

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The Mogollon District

By B. A. Statz

In the Mogollon district, of New Mexico, development continued during 1912, and will, no doubt, show a slight increase in the production of gold and silver over 1911. The Ernestine mine was the largest producer, as it had been in former years. It increased its milling capacity during the year by installing an additional battery of 10 stamps, making 30 stamps dropping on ore at the end of the year. The mill crushed approximately 36,000 tons of ore, yielding about 9000 oz. of gold and silver bullion and about 400 tons of concentrates, having a total gross value of over $320,000.

Next in importance as a producer was the Socorro Mines Co. Some improvements were made early in the season by the company for the better handling of custom ores, at the same time tending to increase the capacity of the plant. While the mill handled a larger tonnage than in 1911, as part of it was custom ore it is harder

to get at the total approximate production. However, it is probable that the total ore milled was not less than 30,000 tons, having a value of over $300,000. The Deadwood company put up a new headframe and reset the hoisting plant. A new 50-hp. auxiliary steam plant was installed for the mill, also a new automatic sampler and some large storage bins for the sampling and storing of custom ores. The Deadwood mine, owing to a heavy flow of water encountered in the main drift on the 500-ft. level, did not treat its full quota of ore and the returns are only available for one or two complete months. In August the mill handled 1700 tons of Deadwood ore, but much of the time the mill treated a quantity of custom ore, so that the mill ran fairly steady the whole year. Probably not less than 18,000 tons of ore from its own mine and from other mines in the district was treated; this ore will average not less than $10 per ton.

Perhaps the most satisfactory development work to the owners was the work done by the Oaks company, on the Pacific and Johnson mines. Over 1000 ft. of new ground was opened during the year, and the headings remained in ore practically all the way. During this development enough ore was extracted to nearly meet the monthly pay roll. An average of 100 tons monthly was treated by the local custom mills for the company. The Deep Down was taken under lease early in the spring and shipments were begun within three weeks and continued, sending a good tonnage of ore to the custom mills.

The Little Charlie mine, of the Mogollon Gold & Copper Co., began shipments of an excellent grade of ore in June, and steadily increased the tonnage from month to month. It was also worked under lease. In addition to these principal shippers there were many smaller ones in the district that added their quota, so that the total production for the year, for the Mogollon district will not be far from $1,000,000 in gold and silver.

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South Dakota Mines Prospered

By Jesse Simmons*

The year 1912 was the most prosperous in the history of mining in South Dakota. The mining territory of this state is confined entirely to that portion of the southwest corner of the commonwealth known as the Black Hills district, and of the production of gold more than 95% came from Lawrence County. The activities of the district are confined to the mining of gold ores, and the incidental recovery of the small amount of contained silver. For 1911 the gross production of gold and silver is given at $7,636,555 by the Director of the Mint, and 1912 exceeded it by more than $250,000. The silver production is valued at about 1½% of the gross for the two metals.

Early in 1912 many of the mines were working at a decided disadvantage, extremely severe winter weather interfering at nearly all of the properties, and causing a complete suspension of operations at one mine, the Wasp No. 2, for 40 days. Had the winter been less severe the production figures would probably have been 5% greater. Another item adversely affecting the production was the burning of the Mogul mill in March. After that date this company shipped a small daily tonnage to the Lundberg, Dorr & Wilson plant, at Terry, and for the year the company's production is fully $250,000 below the normal. The Homestake shows a gain in production of $500,000 for the year, and other producers show about normal figures.

The Homestake Increased Its Output and Holdings

The Homestake enjoyed the most prosperous year in its existence, with the greatest production, largest tonnage handled, and the average value of the ore higher than for many years past, the gross production exceeding $6,500,000. In recognition of the faithful work of the employees, the company announced in the latter part of the year that it would pay to its employees a sum equal to 7% of their earnings for the year 1912, this sum to be paid to each man who was on the payroll in December. Notice has also been given of a meeting of stockholders to be held early in 1913, when the proposition of declaring a stock dividend of 15% will be considered. As this idea has originated with and has the sanction of the controlling stockholders, it will undoubtedly be effected. It is understood that the company intends to maintain the same dividend rate that it has paid for a number of years past, viz., 50c. per share per month. This will call for the issuance of 32,760 new shares, and to provide them the capital stock will have to be increased. The increase practically means that the company is capitalizing the improvements and property purchases, which have totaled several million dollars in the last 15 years. During the year the company completed and placed in operation the Spearfish hydro-electric plant, and this, with the Englewood plant, gives a total of 5450 hp. for operating the mills and surface works around Lead. On Oct. 31 there was 2850 hp. of this total being used, the principal applications so far being for the operation of the stamps and rock crushers. The electrification of other machinery is being undertaken, and before the close of 1913 practically all of the developed power will be in use. During 1912 the company commenced work on a building at Lead, to be known as Recreation Hall; it is to be for the use of the employees as a place to spend leisure time. In addition to reading rooms, gymnasium, baths, bowling alley, billiard room, etc., it will contain an auditorium with seats for about 1000. The building will cost in excess of $200,000. For several months in 1912, Superintendent Grier was absent from his duties on account of illness, and his place was ably filled by Assistant Superintendent R. Blackstone. Mr. Grier has returned in good health, and is again at his desk. Dividends for the year totalled $1,310,400.

Wasp No. 2 and Golden Reward Operations

Wasp No. 2, although operations were entirely suspended for 40 days in January and February on account of severe weather, had a prosperous year, disbursing $85,000 in dividends, or 17% on the capitalization. Everything about the property operated smoothly, and a few minor improvements were made. The mill capacity was maintained at 15,000 tons per month, bullion recovery amounting to a little less than $2 per ton.

*Deadwood, S. D.

Golden Reward made a good production, and in addition did important work in erecting a roaster at the Astoria mine. A Wedge furnace was installed, with a capacity of 75 tons per day, it being proposed to give the ore a preliminary roast before sending the ore to Deadwood for treatment in the company's cyanide plant. The plant is built so that with but little trouble the capacity can be doubled by installing duplicates of the present equipment.

The Golden Reward has an immense quantity of milling-grade ore which cannot be handled in the present mill, and tests will be made on roasting as a preliminary to cyanidation. Should this treatment prove successful, it will mean that the problem of the so called "blue ore" treatment has been solved. By the ordinary methods of cyanidation only 25% to 35% of the gold is recovered. Exhaustive tests on the Astoria ores show that it is an ideal cyaniding material after roasting, but it cannot be classed with the usual blue ore of the Bald Mountain district. Tracks have been laid so that ores can be brought from various other properties for roasting. Early in 1912 the company leased a number of the older mines, with the idea of getting the rims, backs and bottoms cleaned up. This was done, no doubt, much more thoroughly and with greater profit to the company than could have been accomplished on company account. In several instances the lessees found new oreshoots and made good productions. All of the milling ore extracted from these leases was treated by the company in the mill at Deadwood, and the smelting grades were shipped to Denver and Omaha.

Additions to Trojan Equipment

The Trojan company operated steadily throughout 1912, handling an average of 200 tons per day in the cyanide mill. Extensive improvements were completed, but in addition much remains to be done when outside work will be permitted by weather conditions. The mill supply comes from three mines, the Decorah, Empire and Portland, the first named being 4000 ft. from the mill. An 18-in. gage track, over which gasoline locomotives haul the ore, connects the Decorah with the mill, while from a point between, skipways run up the hill to the two other properties. The cars are operated over these skipways by electric hoists. Much of this trackage was laid in 1912, and at the Portland a 100-hp. air compressor, electric driven, was installed. At the mill a most complete machine shop was erected, the mill bins and tracks over them completely shedded, a large warehouse, residences, heating plant, etc., constructed. Early in 1913 the mill capacity will be doubled by the addition of leaching tanks and enlargement of the slime department.

The operations of Lundberg, Dorr & Wilson were confined principally to cyaniding custom ore, the majority of which came from the Mogul. The mill capacity is 115 tons per day. A comparatively small amount of ore was taken from the company's properties, the Buxton and Big Bonanza.

During the summer of 1912, the New Reliance mill was remodeled. The mill as now equipped handles the slime by a treatment consisting of continuous decantation in four Dorr thickeners and Portland filter. The mill contains 30 stamps, and is now in steady operation.

Other producers include the Victoria, where the mill was started in the fall of 1912, and the Deadwood Standard, which operated 60 days in the summer, suspending until the summer of 1913. The ore showing at both of these properties is encouraging, and their production in 1913 will probably be much greater than in 1912.

The Richmond Operating Co., at Galena, shipped a considerable quantity of lead-silver ore to the Omaha smelter. The Monarch mine, under lease to Nickoli brothers, produced a considerable amount of high-grade gold ore, which was shipped to smelters. A number of smaller properties produced varying amounts, a portion of which was milled locally and the balance smelted at plants outside of the Black Hills.

Among the new properties which have been exploited are the Bismarck, where a 300-ton cyanide plant has just been completed, and is practically ready for operation. This adjoins the Wasp No. 2. The Forest City property, near Hill City, was equipped with a model five-stamp mill, and has been in steady operation for several months. The Otho company, at Spokane, is erecting a plant, a portion of the machinery being secured from an old mill at Mystic. The Black Hills Smelting Co. completed a small smeltery at Galena, and will shortly commence operations. The plant is designed to operate on the pyritic process. The sulphides will be secured from the Gilt Edge and other Galena properties, and dry ores from the Richmond, at Galena, and a number of the Bald Mountain properties.

The Republic Mining Co. in the fall of 1912 started development on the property on Blacktail Gulch, installing an electric hoist and repairing an old shaft to the 100-ft. level. From this point, which is at the quartzite level, lateral workings will be undertaken. The North Homestake completed the shaft to the 600-ft. level, and did several hundred feet of crosscutting at that level. Altogether 1912 was a good year, but 1913 promises to be even better.

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Mining in Arizona in 1912

Arizona was the premier copper-producing state in 1912; it ranked sixth in the production of silver in 1911 and seventh in the production of gold. The total value of the mineral production was about $65,000,000, an increase of more than $20,000,000, or 49% above that of 1911. Copper was by far the most valuable product and that subject is treated in other articles by James Douglas and J. Parke Channing in this issue of the JOURNAL.

Tom Reed and Gold Road Principal Gold Producers

The production of gold showed an increase of about 3%, and was worth approximately $3,500,000. The most important producing mines, the Tom Reed and Gold Road, in Mohave County, made a record of $1,800,000 to $2,000,000 for the year. Of this sum about $1,100,000 goes to the credit of the Tom Reed, which is now paying a 7% monthly dividend, or about $65,000 per month. Developing mines are the Lexington-Arizona, Leland-Mitchell, Pioneer, Boundary Cone, Curry & Alexander, Iowa, Tom Reed Extension, Telluride, Sunnyside, Crown City, Ruth and numerous smaller properties. The Lexington-Arizona, about one mile south of the Tom Reed.

has three shafts going down. The Pioneer has 4 ft. of good ore in its north 200 level. The Leland-Mitchell recently equipped for deep work, is sinking to 600 ft. A mill is to be built on this property, providing the development of the coming year is satisfactory. At the Boundary Cone mine work was suspended for two weeks, but is to be resumed Jan. 10. The main working shaft of the Boundary Cone company is down 510 ft. At the 550 station a drift will be started east to encounter the rich free-gold streak opened at a depth of 450 ft. At the Tom Reed the development of the outlying properties is going forward steadily, the mine and mill giving employment to 80 men. Shaft No. 4, started a few weeks ago, is now ready for its hoist, and it is stated that No. 5 is to be sunk on the recently purchased Aztec ground, the five shafts developing about 9000 ft. of vein length. The Tom Reed mill is crushing 80 to 100 tons daily from the mine, the rest of the material milled being tailings. One of the problems involved in handling the ores of the district is the excessive cost of electric power, which was until recently $14 per hp. per month. It is understood that a new contract, at much lower figures, has been made by the Gold Road company.

Silver production increased about 2%; the total output was worth about $2,000,000. Some of the increase is attributable to the shipments of argentiferous lead ore from Mohave and Cochise Counties. Among the shippers of silver ore was the World's Fair property which, it is claimed, received far greater returns per ton on its total shipments for the year than any other mine in continuous operation in the state. The total tonnage shipped was not large. It was reported at the close of the year that the Copper Queen's engineers had made an examination and that an offer had been made to the owners of the property.

Production of Lead Decreased

The production of lead was about 7,000,000 lb., or nearly one-third less than in 1911. However, the lead production of that year was exceptionally high, and the lead output of 1912 exceeded that of the last eight years, excepting 1911. The ores and concentrates were shipped to El Paso, Tex., or Needles, Calif., there being no lead smeltery in Arizona.

The production of zinc showed a remarkable increase; the total output will probably amount to 8,500,000 lb. One of the most important producers was the Golconda mine at Union Basin, in Mohave County. This mine shipped, during one of the autumn months, about 35,000 tons of ore and concentrate.

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Mining in Nevada in 1912

The value of the mineral products of Nevada for 1912 will probably total about $36,000,000, or a fair increase over the production for 1911. Gold was still the most valuable mineral product of the state, although its copper production was of nearly equal value. The status of the copper industry in the state is treated in another article in this issue of the JOURNAL.

The gold production was less than in 1911, and with the exhaustion of the rich orebodies of the Goldfield Consolidated, the gold output of the state will probably lose its premier position unless some new rich discoveries are made. More gold ore was milled in 1912 than in 1911, but the grade of the ore treated at Goldfield, and in the National and Seven Troughs districts was lower. At the National mine the mill was burned in September and in July a cloudburst at Seven Troughs interfered with mining work. In Manhattan, Round Mountain and Fairview the production of the gold mines increased. The grade of Goldfield Consoldated ore fell from $25 per ton in January to $13 per ton in September; the company passed a dividend in December. The gold production of the state was about $13,500,000. The Aurora, Rexall and Rochester districts are about to become producers of gold.

The production of silver increased nearly 23%, due to the increased production of silver at Tonopah and shipments of lead ore from Pioche, in Lincoln County. There was an increase in lead and zinc production, the product coming chiefly from the Pioche and Yellow Pine districts. The last district, which is in Clark County, broke all records of zinc-ore production in Nevada, producing nearly 12,000,000 lb. of zinc. The chief producer was the Yellow Pine mine, which operated the only concentrating mill in the district. The lead production from the district also increased. The adjustment of litigation at Pioche favorably affected that district, and the completion of a railroad spur to the Bullionville dump afforded a much-needed outlet for its ores.

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Prosperous Year at Tonopah

SPECIAL CORRESPONDENCE

The vigorous growth of the mining industry in Tonopah is evidenced by the increase in production from about 400,000 tons of ore of a gross value of more than $8,000,000 in 1911, to approximately 474,521 tons of a gross value of $9,110,955 in 1912. The list of regular producers was augmented by one new mine and by one old mine that after a lapse of several years reëntered the producing ranks. Many new or rejuvenated companies have started intelligent exploration work with excellent prospects of satisfactory results. Dividends paid amounted to $3,331,550, as against $3,060,624 in 1911.

Production of the Various Mines

The metal output for 1912 was approximately 112,642 oz. gold and 11,027,736 oz. silver. The Tonopah Mining Co. produced 174,000 tons, containing approximately 40,682 oz. gold and 4,012,950 oz. silver of an estimated gross value of $3,261,035, and with an estimated profit of $1,672,724; the Tonopah-Belmont Development Co. produced 125,470 tons, containing approximately 39,826 oz. gold and 3,928,489 oz. silver of an estimated gross value of $3,182,622, at an approximate profit of $1,823,539; the Tonopah Extension Mining Co. produced 53,195 tons containing approximately 8886 oz. gold and 857,398 oz. silver, of an estimated gross value of $766,669, at an estimated profit of $233,945; the Montana-Tonopah Mining Co. produced 53,910 tons of

an approximate gross value of $808,650; the West End Consolidated Mining Co. produced 40,588 tons containing 9137 oz. gold and 900,309 oz. silver, with an estimated gross value of $742,274, at an approximate profit of $250,000; the MacNamara Mining Co. produced 19,203 tons containing approximately 2534 oz. gold and 236,959 oz. silver, of an estimated gross value of $222,562; the Jim Butler-Tonopah Mining Co. produced 6067 tons, containing 1079 oz. gold and 99,639 oz. silver, of an estimated gross value of $83,712; the Tonopah Merger Mining Co., in the last six weeks of the year, produced 1650 tons of a gross valuation of $27,003; the Tonopah-North Star produced 438 tons, containing 546 oz. gold and 11,619 oz. silver of an approximate gross value of $16,435.

The Tonopah Mining Co., for several years past accredited as one of the greatest gold-silver producers in the United States, made its usual large production in 1912, and paid its normal dividends of $1.60 per share, or a total of $1,600,000 in 1912. The Tonopah-Belmont Development Co., despite a four months' period of greatly reduced production enforced by reason of the complete retimbering and consequent cessation of operations through its main shaft, showed an increased production in tonnage and value. This property opened in 1912 many new veins and paid dividends of $1 per share, or a total dividend of $1,500,000 in 1912. The Montana-Tonopah Mining Co. increased its ore reserve greatly, having found a large body of rich ore in the "Shaft" vein, beside other new orebodies in "Triangle" and "Martha" veins. This company paid dividends amounting to 20c. per share, or a total of $200,000 in 1912. The company acquired control of the Commonwealth mine in Arizona, where a new 350-ton mill and cyanide plant is under construction. The Tonopah Extension greatly increased its ore reserve over that of 1911. The property is in splendid physical condition and a new three-compartment shaft, to become the main operating shaft, is being sunk. In 1912, this company paid dividends of $75,000. The West End company developed a large tonnage of ore above the 500-ft. level and is sinking its main shaft to the 1000-ft. level and crosscutting for the vein on the 600. This company owns control of the Halifax Mining Co. The MacNamara Mining Co. has at present greater ore reserves than in February, 1912, the date of commencing operations in its new mill. The Jim Butler-Tonopah Mining Co., after several years of unremunerative prospecting and development work, found ore on the 300-, 500- and 600-ft. levels from its Wandering Boy shaft, and from development work alone is making daily shipments of 50 tons. The extent of the orebodies is not yet determined, but the property seems to have better prospects than at any previous time. The Tonopah Merger, the new company that took over the holdings of the old Golden Anchor and Midway Extension companies became a producer in 1912. The company resumed the sinking of the old Golden Anchor shaft and at 980 ft. encountered ore on a contact of underlying Montana breccia and overlying West End rhyolite. Developments to date have proved a large shoot of good-grade ore, and from development work alone daily shipments of 50 tons are being made.

About 14 companies, other than those mentioned, are vigorously pushing prospecting work; nearly this number of new shafts are being sunk at present. Of these, the Halifax, east of the Belmont, reached the greatest depth, 1400 ft. This prospecting work is being performed, both to the east and to the west of the developed ore zone.

New Mills

The mills of the district were added to by the West End company's 20-stamp mill, which was started in November, 1911; the MacNamara company's 10-stamp mill, started in February, 1912, and the new 60-stamp mill of the Tonopah-Belmont Development Co., at Tonopah, started in July. All the new mills were equipped with tube mills for regrinding, and at present all the mills in the district, with one exception, slime the total product, and the per stamp capacity of the mills is much greater than in 1911.

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Mining in White Pine County

By G. L. Sheldon*

The Nevada Consolidated, as a whole, had a successful year in 1912, although about a month was lost because of the strike in the autumn. At the mine, both the Eureka and Liberty pits were put in shape for steady operation with the overburden stripped, so that a large production can be made from either. The ground between the two pits is getting narrow and in six months or perhaps less they should be connected. It is understood that a contract was made with the Butte & Ely company to extract ore from its ground on the south side of Liberty pit, it now being stripped up to the Boston & Ely line. This will give the Nevada Consolidated the desired width, so that operations can be carried on to greater depths in both pits. It is said that there is 275 ft. of commercial ore below present lowest level of Eureka pit. Recently a drill hole was put down from next to the lowest bench of Eureka pit, to a depth from the original surface of nearly 900 ft., the deepest hole drilled. But little drilling was done to prove ore, as nearly 40,000,000 had been blocked out.

At the concentrator the most important improvement made was probably the increase in the capacity of the settling tanks. Formerly they were so small that there was no time for the slime to settle. Experiments are being made to effect a greater saving from slime. By the substitution of California fuel oil for coal, costs have been lowered and the capacity of the reverberatories materially increased.

The Veteran mine, the old Cumberland-Ely property, was put in shape for a production of about 700 tons per day. The ground was in bad shape, and with only one shaft it required a great deal of work to be kept in working order. New ore was opened to the south and west, materially increasing the ore reserves.

The Giroux Consolidated Mining Co. made its first important shipments of commercial ore. Up to the time of the strike, Oct. 1, the production for the previous five months had been approximately 1000 tons per day. This ore came from the Morris and Bunker Hill shafts. Under the contract with the Nevada Consolidated it was shipped to the Steptoe smeltery, at McGill. According to the quarterly statement filed with the county assessor, there was scarcely any profit made on this ore. After the strike efforts were concentrated on completing the surface orebins and the underground ore pocket, and

*Ely, Nev.

widening the main drifts for hauling the ore cars by mules. At the close of 1912 shipments were about 500 tons per day. It is expected that the maximum of 1200 tons per day, as contracted for with the Nevada Consolidated, will soon be reached.

The Butte & Ely, which is between the Giroux and the Nevada Consolidated, and the control of which is held by the Giroux, is believed to be a valuable piece of ground. During 1912 one and part of the time two drills were in operation prospecting the ground, with good results. The Nevada Consolidated also did some drilling, by contract, on the Boston & Ely ground, near the Liberty pit. The Boston & Ely, during the year, tried to explore its ground from the 1200-ft. level with a diamond drill, but the formation was not favorable for drilling work, which was abandoned. Later, in drifting from the 1200-ft. level, crosscutting the country in a search for known surface veins, a previously unknown vein was cut that carries some ore, but produces much water.

The Coppermines Co., Gunn-Thompson property, the ground of which is close to the Star Pointer of the Nevada Consolidated, shipped, previous to the strike, several carloads of ore assaying 5% or 6% copper. After the strike operations were resumed, but no shipments were made. The Ely Central company, which has been in the limelight for a number of years has, during the last year, passed through reorganization. The old debts and encumbrances were wiped out, and the company started in, in a business-like manner, to prospect its ground with two churn drills.

The Smoky Development Co. did several hundred feet of development work on its property, just above Lane City, in Robinson Cañon. There is commercial ore in the breast of several drifts. The mines are exceptionally well situated for cheap transportation, as a few hundred feet of a spur from the Nevada Northern R.R. will allow dumping ore from the tunnel level into cars. The McDonald-Ely company, owning property between Lane City and the town of Ely, placed $100,000 worth of bonds and started in to develop thoroughly its property.

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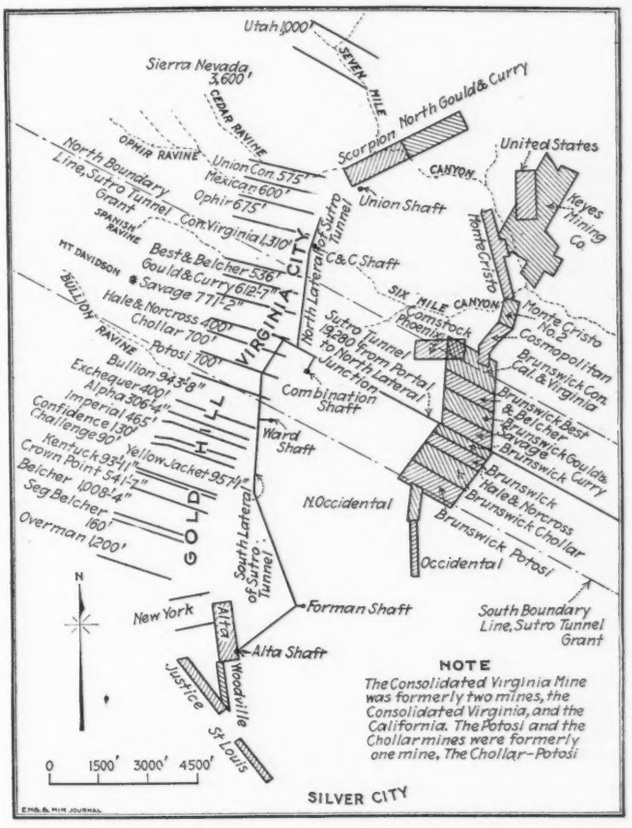
The Comstock Lode

By Whitman Symmes*

Mining on the Comstock Lode did not prosper in 1912. The reason for this lay largely in the fact that there are in all 29 different companies, which are not all in agreement on a policy of unwatering, and exploring the lode. In 1912 there was at one time considerable dispute between the Mexican and the Union as to ventilation. At the north end the water level remained a few feet below the 2500-ft. level, just where it was in January, 1911, when the Mexican first encountered the ore which it has since been stoping. Some new centrifugal pumps were installed at the C. & C. shaft and successfully handled the water formerly lifted from the 2500 sump by the Evans hydraulic elevators. Other pumps for unwatering the north-end mines to the 2700 level, through the old joint Ophir and Mexican winze, have been on hand for some time, but the work of installation was held up owing to inability of many of the companies to contribute to the Comstock Pumping Association, and differences as to the proportion that each should pay. The pumping association exists by verbal agreement; it has no written contracts with the different mines. The Mexican paid $109,000 to the pumping association during its last fiscal year, and some of the other companies want it to increase its proportion. At present it is the only north-end mine that is producing ore. The five north-end mines have been paying for practically all of the pumping.

The Ward shaft was offered by the pumping association to the Sturges and other Gold Hill mines. It contained pumps with a total capacity of 3000 gal. per min. from the 2475 level to the Sutro tunnel, but the offer was declined. The pumps were then removed, and the shaft was closed. This lifted a great financial burden from the five north-end mines, which were paying to operate the Ward shaft, through the pumping association, although it did not benefit them, in the hope of starting pumping generally along the lode. The Sturges interests stated that they are going to unwater the Gold Hill mines by installing pumps in the Crown Point.



Mines on the Comstock Lode, Nevada

In 1912 the Mexican produced 20,000 tons of ore, averaging about $23 per ton. On account of the slowness of lowering the water and the consequent lack of new ground to explore in the Comstock Lode, Mexican has lately taken an option on the Keyes property, one mile east from its mill. The Keyes was unwatered and is now being sampled. The Mexican also took control of a lease on the Monte Cristo, adjoining the Keyes, and is building an aërial tramway to it. The Monte Cristo has some $10 ore in sight. Ophir ran out of ore and for the first time in five years had to levy an assessment. The

*Superintendent, United Comstock Pumping Association; superintendent, Mexican Mining Co., Virginia City, Nev.

Crown Point and Belcher mines, in Gold Hill, milled large quantities of $5 to $10 ore, but as there was no cyanide plant in connection with the concentrating mill, the extraction was poor. Mexican completed construction of its mill and cyanide plant, and began milling early in the year, and Ophir completed a 100-ton cyanide plant in October to treat an accumulation of tailings stated to consist of 22,000 tons sampling better than $5. These tailings have lately been saved from the ore worked at the Kinkead custom mill. The market for Comstock shares, which are handled principally on the San Francisco exchange, is at present depressed, and once again it looks as though mining on the Comstock will soon have either to be mended or ended.

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Mining in Alaska in 1912*

It is estimated that the total value of the mineral output of Alaska in 1912 was $21,850,000, compared with $20,650,000 for 1911. The value of the gold output of 1912 is estimated at $16,650,000; that of 1911 was $16,853,256. It is estimated that the Alaska mines produced 28,940,000 lb. of copper in 1912, valued at about $4,630,000. In 1911 the output was 27,267,871 lb., valued at $3,364,584. The silver production in 1912 is estimated to have a value of $300,000, as compared with $243,923 for 1911. The value of all other mineral products in 1912, including tin, marble, gypsum, coal, petroleum, etc., was about $260,000, compared with $176,942 in 1911. The total value of Alaska's mineral production since 1880, when mining first began, is, in round numbers, $229,000,000, of which $202,000,000 is represented by the value of the gold output. The total output of copper in Alaska since 1901 is about 90,000,000 lb., valued at about $13,145,000.

Value of Total Output Increased

The increase in the value of Alaska's mineral output is to be credited to the larger copper output as compared with the previous year. While no new copper properties were put on a productive basis, a large amount of development work was accomplished in several of the copper-bearing districts. The gold-mining industry was marked by important advances in developing lode deposits. Work was continued on a number of large lode-mining enterprises in the Juneau district, and advances were made at Fairbanks and in other districts. In addition to this, promising discoveries of auriferous quartz were made at Port Wells and in the Innoko-Iditarod region, as well as in other parts of the territory.

The output from the placer mines was less than in the previous year. On the other hand, discoveries of rich auriferous gravels were made on Hammond Creek and in the Koyukuk Valley, and workable placers were found in the Ruby district. Extensions of gold-bearing gravels were also found in several of the older districts. The installation of large plants has not yet gone ahead rapidly enough to insure the keeping up of gold-placer production. It is significant, however, that the output in Seward Peninsula was practically the same as that of 1911. The maintenance of this output in Seward Peninsula is to be credited to the installation of dredges, which was continued in 1912 as in the previous year. The data at hand indicate that in 1912 about 40 dredges were operated in Alaska, besides a number of others under construction. Of these, three are in the Fortymile district, one in the Fairbanks district, one in the Birch Creek district, one in the Iditarod district, one on the Kenai Peninsula, and the rest on Seward Peninsula.

There has been no change since the previous year in the opening of coal fields. One coal mine was operated for a part of the year at Chignik, in the Alaska Peninsula, and the mining of coal for local use was carried on in a small way at several other places. Investigations were made in the Bering River coal field under the joint auspices of the Navy Department and the Bureau of Mines to determine the availability of the coal for naval use. One well was drilled at Katalla, and there was a small production of petroleum from this field, the oil being refined near the well and the gasoline disposed of in the local market.

Except for the continuation of the work of the Alaska Road Commission in the building of wagon roads and trails, there was no marked improvement in transportation facilities during the year. The total railway mileage for Alaska in 1912 is 465, the same as in the previous year. Most of the railways were operated, except those in Seward Peninsula. The Copper River & Northwestern was blocked by land slides for about six weeks in the early fall.

Greater Production from Gold Lodes

There were about 22 lode mines in Alaska that produced gold in 1912, compared with 18 in 1911. In addition to this, development work was done on many lode prospects widely distributed over the territory. The value of the output from the auriferous lodes in 1912 is believed to be about $4,600,000, an increase of about $400,000 over that of the previous year. This increase must in large measure be credited to the Treadwell group of mines, but there was also a large production from various small properties in different districts.

The most noteworthy mining advances in the territory in 1912 were those in the Juneau district. The Treadwell mine increased its gold output. Work was continued on the 6000-ft. tunnel of the Alaska-Juneau mine and was begun on an adit tunnel of the Alaska-Gastineau, which will be about two miles in length. This tunnel is to undercut the Perseverance mine, which, with adjacent properties on Sheep Creek, has passed under one management. The ore is to be carried to a mill of 6000 tons daily capacity, which is to be erected at tidewater. These enterprises, together with the continuation of work on the Kensington mine and the reopening of the Jualin mine, in the Berners Bay district, constitute an assurance that the production of gold in Alaska will not fall off, even aside from the promise of a larger output from other parts of the territory. It is reported that discoveries of rich gold-bearing quartz veins have been made on Funter Bay, Admiralty Island. Two mines were operated in the Sitka district, as in the previous year, and the discovery of a new gold-bearing quartz vein in the district is reported.

*Abstract of preliminary report of Alfred H. Brooks to the director of the U. S. Geological Survey.

There was considerable advance of auriferous lode mining in the Ketchikan district in 1912. The Goldstream mine was again operated, supplying a five-stamp mill. A 10-stamp mill was installed at the Valparaiso mine. It is reported that the Lon de Van Co. intersected an auriferous galena-bearing vein at a depth of 1100 ft. on its property on Georges Inlet.

The Cliff mine, of the Valdez district, continues to be the only gold-lode property in the Prince William Sound region which made any substantial output. In the aggregate, however, a quantity of ore was recovered from other properties incidentally to development work.

Work was continued on the auriferous lodes of Kenai Peninsula and the Willow Creek district. Three small mills, two on Falls Creek and one on Porcupine Creek, were operated for a part of the year. In addition to these, two arrastres and one prospecting mill were operated in the Moose Pass district. Work was also done on properties on Porcupine Creek, near Seward, and on Palmer Creek, near Sunrise. A gold-lode prospect was opened near Bird Point, on Turnagain Arm, and a small shipment of ore for testing was made. Three mills were operated in the Willow Creek district, and development work was advanced. It is reported that two of these properties are to be consolidated and opened on a large scale. The information at hand indicates that several promising discoveries of auriferous lodes were made in this district during 1912.

Lode Mining Active in Fairbanks District

Although the output from the Fairbanks placers has decreased, there was far greater activity in lode mining and prospecting than in the previous year. Most of the operations were conducted on a small scale, and the total output of gold was not large, but a large amount of development work was accomplished in 1912. In 1912 six stamp mills, aggregating 24 stamps, were operated for a part of the year, and six other mills were being installed in the late summer and some of these were put into commission before the close of the year. Statistics at hand indicate that the average recovery of free gold from these operations is about $50 per ton. In only two places are the concentrates being saved, though they undoubtedly contain additional gold.

Lode prospecting has continued with increasing activity in 1912, and probably more than 200 men were engaged in this work. As a result a number of quartz veins were disclosed, some of which promise well. The notable features of the lodes are their great number, small size, and high tenor. Most of the veins from which free gold can be obtained by panning are composed almost entirely of quartz, with sulphides either absent or present only in subordinate amounts. Stibnite is the most common of the sulphides. Most of the veins have been discovered in two areas—one stretching east and west from Pedro Dome and the other in the vicinity of Ester Dome.

The influx of prospectors into the Innoko-Iditarod region during the last two years stimulated the search for lode deposits, but little was accomplished in actual development. In 1912 an auriferous-quartz deposit was opened on Gaines Creek, and a small mill was installed. This operation was successful and is an indication of the possibilities of lode mining. More important is the fact that many other metalliferous veins were found and that the geologic conditions are favorable to their occurrence in considerable areas of the Innoko basin and adjacent portions of the Kuskokwim basin.

The Apollo mine, on Unga Island, continued in 1912 to be the only productive lode mine in southwestern Alaska. Some work was continued on lode prospects in the Iliamna region, notably on the Duryea silver-lead deposit.

There was but little advance in quartz mining in 1912 in Seward Peninsula. Some prospecting was done, as well as assessment work on a large number of claims. The New Era Mining Co. opened a quartz lead near Snow Gulch, where a four-stamp mill was installed. Considerable ore was also treated at the Nome custom mill. Plans were also made to install a stamp on a property situated near Bluff, 60 miles east of Nome.

Increased Copper Production

The increased copper production of 1912, compared with 1911, is to be credited to the Chitina and Prince William Sound districts. The rise in the price of copper led to much prospecting and deadwork in these as well as in other districts.

The Jumbo and Rush & Brown mines were the only large shippers of copper ore in the Ketchikan district. It appears that the Mount Andrew mine was idle for most of the year, but plans were formulated for systematic development. Developments were continued on the It, the Red Wing, the Vittory, and the Lhote & Sanford properties, and steps were taken looking to the reopening of the Copper Mountain mine. Some work was also done on a copper-bearing vein at Sum Dum, in the Juneau district.

The Kennicott-Bonanza mine is the only one in the Kotsina-Chitina district from which shipments were made in 1912, but a large amount of development work was done on other properties. The concentrator installed in 1911 at the Bonanza mine was operated during 1912. At the east end of the field, work was continued on the Mother Lode, Nikolai, and Westover properties and also on a property located on an island in the Kennicott Glacier. Prospecting and developing were especially active in the vicinity of Kuskulana River. Here the largest operations were those of the Great Northern Development Co., which completed about 5000 ft. of development work. The Alaska Consolidated Copper Co. carried on development work on Nugget Creek and on the Rarus group of claims. The Alaska United Copper Exploration Co. continued work on the Blackburn group of claims, on Porcupine Creek.

On Prince William Sound shipments were made by the Ellamar Mining Co., the Threeman Mining Co., the Landlocked Bay Copper Mining Co., and the Beatson Copper Co., on Latouche Island. In addition to productive properties, there were a large number of claims on which development work was carried on, some of which give promise of soon reaching a shipping stage. A notable advance was that made on the Solomon Gulch property, near Valdez, where a force of men was engaged in 1912 in opening a chalcopyrite orebody.

But little advance was made in copper prospecting in those inland districts which are far from transportation. About 25 men are said to be carrying on prospecting and assessment work in the White River region, and there are also some in the Nabesna district. Prospectors report the finding of copper ore on Sheep Mountain, in the Matanuska Valley. Some copper ore was also found on a

tributary of the McLaren River, in the headwater region of the Susitna. A little development work was also continued on the copper prospects of the Iliamna region, in southwestern Alaska.

The dredge for working tin placers installed on Buck Creek, in 1911, was operated throughout the open season of 1912. It is currently reported that the output of 1912 is much larger than that of 1911. The Lost River lode-tin property was bonded and is now being systematically developed. The results of these operations in 1912 are reported to justify further investments and the installation of a mill. This property promises to become the first productive lode-tin mine in Alaska.

Diminished Yields from Placer Mining

The returns from the Alaska placer mines are far from being complete, but the information at hand indicates that the value of the output in 1912 was half a million dollars less than that of the previous year. This decrease in production is due to the fact that the output from the Fairbanks and Innoko-Iditarod regions was much less in 1912 than in 1911. On the other hand, a discovery of rich placer ground was made in the Koyukuk district, and promising finds were made in the Ruby district and the Innoko-Iditarod region. Moreover, the two years' work brought additional proof of the adaptability of the dredge for placer mining in different parts of the territory. A little mining was done at Juneau and some larger operations were carried on in the Porcupine district. Beach mining continued to employ a score of men at Yakataga and probably as many more in southwestern Alaska, especially on Kodiak Island. The season in the Nizina district was successful except for the floods which occurred in the latter part of the summer and caused much damage to the two large plants there installed. Hydraulic operations were continued on Kenai Peninsula and at Crow Creek, as in previous years. A dredge installed in 1911 was operated on Kenai River for part of the season in 1912. There was also much prospecting in this part of the field for dredging ground. It is reported that the Yentna district had a prosperous season. Increase in production was made on Dollar Creek, where some high gravels were developed.

Fairbanks Leads in Placer Mining

The Fairbanks district continues to lead in the production of placer gold. The new discoveries in this field were principally those on creeks which have already yielded some gold. The most important was on Eva Creek. The work of the year has also increased the area known to be underlain by workable gravels in the Chatanika Flats, near the mouths of Dome and Cleary creeks. Additional gold-bearing gravels are said to have been found on Fairbanks Creek. The Fairbanks Creek dredge was operated throughout much of the open season. The gold produced at Fairbanks came chiefly from Goldstream Creek, the lower parts of Dome and Cleary creeks, and Ester, Eva, and Fairbanks creeks. It is estimated that between 130 and 140 different plants were operated and that from 900 to 1500 men were employed. Summer operations were much in excess of those of the winter.

In the Circle district the placer gold was taken chiefly from the mines of Mastodon, Deadwood, Eagle, Mammoth, Switch, and Independence creeks. It is estimated that about 27 mines were worked during the winter and 32 in the summer of 1912, employing from 60 to 100 men in the winter and from 145 to 175 in the summer. A dredge installed on Mastodon Creek was operated during the summer of 1912. Hydraulic plants were operated on Mammoth, Mastodon and Eagle creeks.

The Fortymile district had a successful season. Three dredges were operated there during the summer. It is estimated that about 25 mines were operated in the winter of 1912 and about 50 during the summer. Many of these were, however, only small plants.

It is reported that the Koyukuk district had a successful season in 1912, but details are lacking at this writing. A large amount of gold is said to have been taken from the newly discovered deep placers of Hammond Creek, and this production may have been sufficient to more than double the output of the district, compared with previous years.

Though the current reports from the Ruby Creek district were rather discouraging, yet it seems certain that this district will become a gold producer of some importance. In 1912 operations were practically confined to six creeks, all lying within a small area about 25 miles south of the town of Ruby, on the Yukon. The creeks on which productive mining was carried on are Long Creek, Upper Long Creek, Bear Pup, Midnight Creek, Glenn Gulch and Trail Creek. About 150 men were employed in this district on 30 claims, and the value of the gold production was probably in excess of $150,000.

About 24 claims, on five creeks and employing 140 men, were worked in the Innoko district during 1912. No new discoveries were made. In the Iditarod district Otter and Flat creeks continue to be the most important producers of placer gold. A dredge was installed on the upper part of Flat Creek during the winter of 1912 and was operated for the latter part of the open season. It is estimated that 34 mines were operated in the Iditarod district in 1912. These were distributed on six creeks and employed about 650 men. Of these plants, one is a dredge, 18 are equipped with steam machinery, and the rest are operated by manual methods.

During the summer of 1912, gold was discovered on Fox Gulch, a tributary of Cripple Creek, 30 miles northeast of Ophir, which created much local excitement. About a hundred men are said to be prospecting in this field. It is reported also that some workable placers were found on Mud River, a northwesterly tributary of the Innoko.

Prospecting continued in the Aniuk River basin, where gold was found in 1911. A small amount of productive mining was done in this region in 1912. Nothing of importance developed in the Goodnews Bay region, where several claims, however, were operated in 1912.

Gold Dredging on Seward Peninsula

There was no abatement in dredge installation on Seward Peninsula in 1912. It is reported that in 1912 39 dredges were completed or in process of erection. The dredge season began in May, but most of the machines were not operated until the first steamers brought in the dredge crews, about June 15. Information at hand indicates that by August about 30 dredges were in operation and that a number of others were started before the close of the season. Dredging continued until about the middle of October. It is a significant fact that these dredges are widely distributed over the peninsula, some being operated or under construction in every district which has yielded placer gold. This brings the final proof that

profitable dredging ground is by no means confined to the vicinity of Nome, to the Solomon River Valley, or to the vicinity of Council, as at first believed. The limitations on profitable dredging seem to be controlled rather by the cost of transportation and especially of fuel than by the physical condition of the gold-bearing gravels. Another significant item is that, in spite of the drought of the early part of the summer and the fact that the value of the winter cleanup was only $400,000, the production of gold for the season was nearly the same as that of the previous year. This indicates that a large part of the gold production came from dredging operations which were not seriously hampered by small water-supply. It is fair to assume, therefore, that the production of placer gold from the peninsula has passed its minimum for many years to come.

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Mining in British Columbia in 1912

By E. Jacobs*

A rough estimate of the quantity of ore produced in British Columbia in 1912 places it at 2,600,000 tons, which is 400,000 tons higher than that of 1910, previously the record year. More than two-thirds of this production was from the copper mines of the Granby and British Columbia Copper companies. In quantities of minerals produced, as compared with 1910 (labor difficulties so interfered with the 1911 production that comparison with that year would not fairly indicate the progress in 1912, but show it at too great an advantage), there was an increase in all but gold and coal, and it is probable that revised returns will show a close approach to record figures in these. The chief increase was in copper.

Gold Production Less Than Expected

Preliminary returns show a smaller production of gold than was expected, as to both placer and lode gold. The 1911 yield of placer gold was the lowest in 17 years; while that for 1912 gives an increase of about 3500 oz., it is much less than was expected. Atlin district is highest, with an estimated yield of $260,000, and Cariboo next with $200,000. All other parts of the province are put down at $15,000. Revised returns may show higher results in both Atlin and Cariboo. The total value is estimated at $485,000, as against $426,000 in 1911. Boundary district, including Hedley, Similkameen, appears to have made a net increase in lode gold of 15,000 oz., and Nelson about 3000 oz. Rossland production was probably about the same as in 1911, while the Coast district is expected to show a decrease. The total production is estimated at 250,000 oz., as compared with 268,000 in 1910.

The output of silver, placed at 2,700,000 oz., is the highest in five years, 1908-1912. Final returns are expected to show a higher total, but available figures suggest the foregoing quantity as a safe estimate. Nearly one-half has come from Ainsworth-Slocum mines, while about 400,000 oz. is from Boundary district mines, in the ores of which both gold and silver are associated with copper, though the last is the chief metal of value. East Kootenay silver production is estimated at between 350,000 and 400,000 oz., that of Coast mines at rather more than 100,000 oz., and from Rossland about 90,000 ounces.

Lead Production

A total of 35,000,00 lb. of lead seems to be a reasonable estimate. Lead contained in ores received at the Trail smeltery is stated to have been about 44,000,000 lb. The estimated production of metallic lead allows for a loss of 20% in smelting. Nearly one-third of the lead produced was from the Standard mine, Slocan, while the Sullivan, East Kootenay, contributed a similar proportion. The Van-Roi and Rambler-Cariboo, in Slocan district, and the Emerald, in Nelson mining division, were the chief of the smaller producers, which included about 20 mines in all.

Deep development work done at half a dozen Slocan mines, that produced little or no ore in 1912, gives promise of an appreciably large addition to production in 1913. To a smaller extent an increase from mines near Salmo, Nelson division, may be expected. Developments at several new properties in the northern country now being opened by completion of part of the Grand Trunk Pacific Ry., through Skeena district, indicate an early commencement of production of silver-lead ores.

During seven months of 1912 the London price for lead was above £18, so no bounty was paid by the Dominion government in that period under the Lead Bounty Act. About $65,000 was paid as bounty on lead in ore mined during the first five months of the year. Approximately $700,000 of the original amount of $2,500,000 voted under the Lead Bounty Act ten years ago remains unearned. Under the present act, payment of bounty will "cease and determine on Jan. 30, 1913."

Copper Output Largest in History

The year's production of copper, nearly 50,000,000 lb., is without question the largest in any year in the history of copper mining in the province. Comparison with the records of 1908 and 1909 will not correctly show the increase in actual production, for some earlier figures represent the copper contents of the ore, while those for 1912 give the copper recovered. A glance at the figures of the few larger mines will show that the above estimate is well based. For instance, Granby's ore output was more than 1,200,000 tons; with a recovery of 18 lb. of copper per ton, 22,000,000 lb. are accounted for. British Columbia Copper Co. (including New Dominion) mines made an output of about 620,000 tons of ore; at only 16 lb. of copper to the ton, approximately 10,000,000 lb. are accounted for. Coast mines are officially stated to have recovered fully 15,500,000 lb., while Rossland mines are credited with 2,500,000 lb. At 16c. per lb. (the average will be a fraction higher), the value of the year's output is within the mark at $8,000,000, which for actual production of copper, constitutes a record year for this metal.

An estimate of the crude zinc ore shipped gives a total of less than 3000 tons, and of silver-zinc concen-

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trate between 5000 and 6000 tons. The chief shipping mines are situated in Slocan district; crude ore was shipped from the Lucky Jim and Noble Five, and concentrate from the Standard and Van-Roi. Beer, Sondheimer & Co., with works at Bartlesville, Okla., through its agent, J. L. Retallack, has purchased the zinc output of the Standard, Van-Roi, Hewitt (Silverton Mines, Ltd.), and Monarch. The French process for the reduction of lead-zinc ores, concerning which much was heard about a year ago, has not yet been advanced beyond the experimental stage. While the development of deposits of iron ore on Vancouver Island has continued, there was little, if any, commercial production of iron during the year.

Coal and Coke

The total production of coal was approximately 3,040,000 long tons gross or, deducting that made into coke, about 2,645,000 tons net. The highest previous year's output was in 1911, with 3,139,000 tons gross and 2,800,000 tons net. The output of coke was 263,000 tons, with a single exception (that of 271,000 tons in 1908), the greatest quantity yet produced in the province in one year. Labor troubles at two of the Vancouver Island collieries interfered somewhat with production, otherwise the total would easily have been higher than that of any other year. Vancouver Island mines produced about 1,553,000 long tons of coal, gross, Nicola Valley and Similkameen 191,000, and Crow's Nest Pass 1,296,000 tons. All the coke was produced in the Crow's Nest Pass district, southeast Kootenay. Three new mines are being opened on Vancouver Island.

The new field, in which anthracite coal is stated to occur, situated in the northern Skeena country, was further explored, but it is without transportation facilities, so little substantial progress was made. Prospecting coal measures on Queen Charlotte Islands was also continued.

Platinum in Nelson mining division appears still to be a "will o' the wisp." No important progress was made toward commercial production of this mineral. Gypsum deposits are being utilized. The demand for portland cement was in excess of manufacturing facilities in the province, so much was imported. The output of building stone, clay products, etc., was larger than in any earlier year.

Prosperous Year in British Columbia

On the whole, the year was the best in the history of mining in the province, and the outlook is good for further improvement. For the first time for a number of years, companies operating metalliferous mines in British Columbia paid dividends aggregating nearly $1,200,000. These were the Hedley Gold Mining Co., Consolidated Mining & Smelting Co., Standard Silver-Lead Mining Co., British Columbia Copper Co., and Le Roi No. 2, Ltd. In addition, the Granby company made nearly $1,500,000 net profit in 1912. Much important development work is being done, and mine equipment is now such that increased production is confidently expected.

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Ontario Mineral Output Increased

By Thomas W. Gibson*

The gold output of Ontario in 1912 amounted to nearly $2,000,000, four times as much as in any previous year. The bulk of the output came from Porcupine, where the principal mines are the Hollinger and Dome. The latter began to produce early in the year, and the Hollinger in July. The future of Porcupine depends largely upon the success of these two properties, which, from the first, have been vigorously operated and well managed.

Gold Occurs Differently at Dome and Hollinger

At both mines, the gold is found in quartz, but the ore occurrences are dissimilar. At the Dome the gold outcrops in large masses or so called "domes," intermixed with schist which is also gold bearing. Consequently the open-cut method is followed, and both quartz and schist are milled. The Hollinger, on the other hand, is characterized by well defined veins, upon which shafts are sunk and levels run in the ordinary way. The deepest working level is at 300 ft. This mine began paying dividends in November, and the management expects to distribute $40,000 monthly.

The Jupiter, McIntyre, Vipond, and other smaller mines are also now producing, or are preparing to do so. In 1912, a branch line of the Timiskaming & Northern Ontario Ry. was built into Timmins, the townsite of the Hollinger. Power is transmitted by electricity from Sandy Falls and Wawaitan Falls on the Mattagami River. A labor strike took place in November against a proposed reduction of wages from the scale adopted in the pre-railway stage, which possibly had some effect in lessening the gold production.

Other gold camps in northern Ontario being developed are Swastika, Munro and Larder Lake, but as yet the actual production from these has been small. The St. Anthony mine, at Sturgeon Lake, continued to yield, and the old Cordova mine, in Hastings County, was reopened.

Output of Silver Less But Value Greater

The silver mines of Cobalt enjoyed in 1912 a productive and prosperous year. Their output was about 30,000,000 oz., or 1,500,000 oz. less than in 1911, but owing to the higher prices for silver the value was much greater, say, about $17,000,000. The chief producers were: Nipissing, Coniagas, Crown Reserve, McKinley-Darragh-Savage, Buffalo, Kerr Lake, La Rose, Cobalt Townsite, Cobalt Lake, O'Brien, Wetlauffer-Lorrain, Trethewey, Timiskaming, Beaver, and in Gowganda, Miller Lake-O'Brien and Mann. There was a revival of interest in the Gowganda and Elk Lake districts, and serious work is in progress at several properties in the latter region, into which a branch of the T. & N. O. Ry. is now being built.

The tendency of the Cobalt camp toward home refining is becoming marked, and a number of the mines now have plants for producing merchantable bars. The Nipissing mine, after much experimenting, brought into use

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a novel and highly efficient combination of amalgamation and cyanidation methods for the treatment of its high-grade ore, containing 2000 oz. of silver and upward per ton. The extraction of silver is practically complete and the loss of mercury trifling. The mill was devised by Messrs. Butters and Clevenger, and the results obtained in dealing with these complex and refractory ores, containing as they do as much as 40% arsenic, together with nickel, cobalt, antimony, etc., stamps it as a triumph of metallurgy.

Several new veins of importance were discovered in the camp during the year. At La Rose, Peterson Lake (Seneca-Superior), etc., and the Casey-Cobalt mine, situated on an outlying area of conglomerate about 15 or 16 miles from Cobalt proper, has proved to contain a rich deposit of silver. At the Beaver mine, the shaft was put down through the Keewatin to the underlying diabase, and good ore found in the latter. Cobalt Lake, for which over one million dollars was paid to the government and which for a time was a disappointment, yielded a large quantity of silver during 1912. In the case of several of the mines paying royalty to the government, a lowering of the rate took place. This affected the Chambers-Ferland, Hargrave, Cobalt Townsite and O'Brien mines. No important extensions of silver-bearing territory were made in 1912. About $8,000,000 was distributed by the mines in dividends.

As byproducts in refining the silver ores of Cobalt, large quantities of white arsenic and nickel oxide are yearly produced. Shipments of these materials during 1912 amounted in value to about $400,000. Both the European and American markets for cobalt oxide are now supplied by the product of Cobalt ores.

Nickel Production Largest in History

Nickel mining was active during 1912 and the production was the largest on record, say 21,000 tons. Interesting developments took place showing the ore reserves to be of enormous extent. The Canadian Copper Co. for the last two years has been testing its No. 3 or Frood mine by diamond drills, and the borings are said to have shown this mine to contain over 10,000,000 tons of ore. A four-compartment incline shaft and a three-compartment vertical shaft are now being sunk on the Frood and a large compressor and hoisting plant installed. Important changes were made in the company's smelting plant, the most important of which were the substitution of basic for acid converters and the introduction of reverberatory furnaces.

The Mond Nickel Co. is also carrying on development work at the Frood Extension, adjoining the Frood mine at the north, and containing a projection of the same orebody, which crosses the boundary line at a depth of about 800 ft. This company is building a new smeltery at Coniston, east of Sudbury, which will, no doubt, be ready for operation in 1913.

The Dominion Nickel-Copper Co. has purchased the old Murray mine, formerly owned by the Vivians, of Swansea, also the Gertrude and Elsie mines, lately the property of the Lake Superior Corporation. At the Murray mine seven diamond drills are at present in operation, and 6,000,000 tons of ore are reported at a point about one-quarter mile west of the old workings. In view of these developments the company, which is also interested in the northern nickel range, is considering a change in the site of its proposed smelting works, which may now be established in the township of Snider.

The Alexo mine, in Dundonald township, on the T. & N. O. Ry., has shown that nickel ore in Ontario is not confined entirely to the Sudbury district. Several thousand tons of good ore from the Alexo were shipped during the latter part of the year to the Mond Nickel Co.'s smeltery, at Victoria Mines. The uneasy political situation in Europe has stimulated the demand for nickel, which is distinctly war material, and inquiries were made during the year by large American and European interests with regard to the possibilities of entering the field of production.

Copper a Byproduct of Nickel

The copper production of Ontario comes almost wholly from the nickel mines of Sudbury, and may, therefore, be regarded as a byproduct of nickel, the output being about one-half that of the latter metal. Both the nickel and copper leave the district in the form of bessemer matte, which contains from 75 to 80% of the metals combined, the final separation being made in refining plants at Constable Hook, N. J., and Clydach, Wales. Prospecting for copper was carried on near Dane station, on the T. & N. O. Ry., where the ore appears to be of low grade.

Other valuable byproducts of the nickel-copper ores of Sudbury are platinum and palladium, both of which are recovered in refining the mattes. During the five years ended with 1911, there were obtained at such refining works in the United States 1869 oz. of platinum, and 3536 oz. of palladium. Platinum is now worth upward of $45 per oz., and palladium about the same. From the same source there were recovered during that time 13,196 oz. of gold and a quantity of silver.

Small Production of Iron Ore

The actual production of iron ore in Ontario during 1912 was not great, the chief producer being the Helen mine at Michipicoten. Much progress, however, was made in the effort to render available the low-grade ores at Magpie and Moose mines. At the former the Lake Superior Corporation is installing an extensive roasting plant, designed to remove the sulphur and carbonic acid from the sideritic ore, of which there is a large body. The finished product is in the form of nodules.

At the Moose mine a Gröndal magnetic concentration plant was erected for the production of briquettes suitable for the blast furnace. These carry about 63% of metallic iron, and the sulphur and phosphorus are well below the bessemer limit. Both these properties, it is expected, will be in full operation during 1913. There are a number of titaniferous orebodies in eastern Ontario which have hitherto not been worked, titanium being an element of intractable behavior in the blast furnace. J. W. Evans, of Belleville, has been successful in producing high-grade tool steel direct from the ore by the electric process, and proposes to put up a furnace to treat, on a commercial scale, the titaniferous ore from the Orton mine. Aout 600,000 tons of pig iron were made in Ontario in 1912, mainly from imported ores.

The iron-pyrite deposits of Ontario are extensive, and a number of them are unworked. Perhaps the most important deposit being operated in the Vermilion mine, at Lake Minnetakie, the property of the Northern Pyrites Co. This mine is capable of large production, and a

spur railway is being built to connect it with the Grand Trunk Pacific, about three or four miles distant. In eastern Ontario the mine and acid-making plant, at Sulphide, were in operation in 1912. The Goudreau Lake deposits in Michipicoten have not yet been opened.

Minor Minerals

There is a long list of minor minerals, the aggregate production of which is of large value, and which constitute local industries of importance. These include talc, for the preparation of which there is a mill at Madoc; mica, of which there are a number of mines in Lenark and Frontenac Counties; corundum, worked in Renfrew and Hastings Counties; graphite, mined and refined in Lenark and Renfrew; feldspar, exported to the United States in large quantities from quarries in Frontenac; salt, made from brine raised in the counties of Huron, Lambton and Essex; gypsum, taken from deposits in the valley of the Grand River; petroleum, pumped from wells in Lambton and Kent Counties, and natural gas, which is now found in practically all counties on Lake Erie.

Petroleum continues to decline in yield, and natural gas to increase. The value of the latter in 1911 was $2,186,000, and in 1912 about 10% more. Bricks and lime are produced in large quantities, also building stone of various kinds, and portland cement, which latter industry has attained to large dimensions. The total value of the minerals and mineral substances produced in Ontario in 1912 was about $45,000,000, computed at selling prices at point of production.

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Mining in Mexico in 1912

The revolutionary movements incited by the generals, Orozco and Salazar in the north of the republic and Zapata in the south, kept much of the country in a disturbed condition in 1912, yet failed to achieve any permanently successful result; on the other hand, the federal government, while effectually checking the revolutions, did not capture and punish those responsible for them. The inevitable result of this display of laxity was the uprising of numerous bandits, who, calling themselves revolutionists, attacked small isolated towns and mining camps, pillaging stores and banks, and occasionally holding the superintendents of the larger properties for ransom. These bands were especially active in the states of Sonora, Chihuahua, Coahuila, Durango and Zacatecas, and the region south of the City of Mexico, dominated by Zapata. In the north, mining operations were chiefly curtailed because of the destruction of railroad property, interfering with the shipment of ore and bullion and the delivery of fuel.

The depredations of these bandits and the occasional reports of Indian uprising caused a general impression that mining conditions were far worse than actually was the case. It is true that they had a very pronounced effect in retarding the exploitation of new mines and prospects by foreign companies; advices of the relinquishing of many options have been noted throughout the year.

As to actual interference of the revolutionary disturbances with production, this was probably most marked in the case of the isolated gold and silver properties; the larger camps, such as El Oro, Pachuca, Guanajuato, where there was a considerable number of foreigners, were not seriously troubled by revolutionary disturbances or the depredations of roving bandits. The latest governmental figures indeed show a reported increase of $4,000,000 in the gold output of the last fiscal year. Smelting operations in the interior were interrupted repeatedly, owing to shortage of fuel and ore supplies, due to the tearing up of railway tracks and the destruction of bridges.

Copper production, however, undoubtedly increased in 1912; the high price of the metal encouraged active operation and the three leading producing centers worked almost uninterruptedly. Not a day was lost at the Moctezuma Copper Co., at Nacozari; the Boleo company worked practically undisturbed, and Cananea worked almost continuously at the reduction plant, notwithstanding the several attacks from revolutionists and strikers. The Aguascalientes smeltery operated throughout 1912, though at reduced capacity. The Mazapil Copper Co. operated in Zacatecas without interruption.

Late in the year the disturbances began to assume a more serious aspect in certain parts of the Northern States, often taking the form of demonstrations against the presence of foreigners and particularly Americans. At Cananea the laborers receive the highest average wage paid in Mexico, yet the close of the year was marked by a strike of short duration, but which indicated that a feeling of unrest existed among the laboring classes.

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Aguascalientes

By Bruno Newman*

Mining in Aguascalientes in 1912 was naturally somewhat affected by the unsettled conditions arising from the revolutionary movements in the neighboring states, especially in Zacatecas, in the last few months. But as regards the smelteries at Aguascalientes and San Luis Potosi, the good prices obtaining for metals and the fact that railroad communications were not interrupted at any time more than equalized any depressing effect. In fact some of the mines shut down at the beginning of the Madero revolution have recently been reopened.

There was an evident lack of local protection at the camps, as proved by the recent attack of four bandits on the El Orito mine, of the Aguascalientes Metal Co. The bandits made an attack at night, looted the office, desks and safe, causing a loss of about 2000 pesos and maliciously burned many valuable papers. The El Orito steadily increased its output and is in shape to ship one car of ore per day, but lacks pack animals to handle its production. This same company reopened its San Simon property, in Tepezalá, and is shipping from this mine. Albert Doerr again took active charge of the mines.

The Lead's Queen mine was returned by the R. A. Towne interests to the original owners, who continued the development work of the property. Sylvester Rapp recently returned to the Nopensada and Alta Palmira mines of the Asientos Mining Co., and he intends to re-

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sume operations once more unless prevented by the rebel bands in the adjoining state of Zacatecas.

Gabriel Chavez, owner of the Socorro mine, is shipping steadily to the Aguascalientes smeltery and opening up ore reserves. The car shortage on the El Cobre branch caused him and the Tepezalá mines, of the Guggenheims, considerable trouble. These last mines, under the able management of Charles Lucas, are now among the largest shippers of copper ore to the Aguascalientes smeltery. The Fortuna mines, of the Fortuna Mining Co., after being inactive for several years, resumed operations on a small scale under the supervision of H. F. Lee, of Aguascalientes.

The mining conditions in this state are good and would be better were it not for the continual feeling of unrest and uncertainty, due to the closeness of rebels and bandits and the obvious lack of local protection.

The smeltery at Aguascalientes, in charge of Supt. A. C. Hall, was in continuous operation at about two-thirds capacity; at present only four of the nine furnaces are in operation. The plant changed its fuel base from coal to crude oil, and this change made considerable economies possible. The ore supply was somewhat restricted because of the traffic interruption in the northern section, but ores from the south and east, as well as fuel oil, coke and lime over the Tampico and San Luis Potosi branches arrived without delays.

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Large Mines in Zacatecas Unmolested

By W. G. Matteson*

The mining industry of the state of Zacatecas was not affected materially by the revolution during the last year. Small, scattered, marauding bands of so called rebels, bent largely on pillaging expeditions, caused the shutdown of small, isolated mines and the suspension of development work on prospects. Well organized companies of several years' standing were subjected to little molestation; in fact, the majority of such corporations show a better balance sheet than for 1911, when the short, decisive Madero revolution swept the country.

Mazapil Copper Co. Operated Steadily

At present, the most extensive mining operations are being conducted in the northeastern part of the state, in Mazapil and adjoining districts. Chief among these is the Mazapil Copper Co., Ltd., with mining headquarters at Concepcion del Oro. This company operated three groups of 12 mines under full force for the entire year, giving employment to more than 2000 natives and a large number of foreigners. It is ideally situated as the ore, fuel and flux can be obtained within a radius of a few miles of the smeltery.

The main group, comprising the Socavon General, San Carlos, San Juan and San Antonio mines is at Aranzan, three miles northwest of Concepcion del Oro. The orebodies, which are largely in the limestone, are irregular in shape and contain numerous horses of calcite, making it necessary to send all run-of-mine products to a picking belt. The present output averages 17,000 tons of run-of-mine ore per month.

About 1½ miles to the southeast of Aranzan and within a mile of the smeltery, this company is operating the Cabrestante, La Concepcion, Cata Arroyo and Vencedora mines for flux with a monthly output of 7000 tons of pyrite carrying 16 to 40% sulphur and 200 to 600 tons of iron oxide.

A little to the south of the Cabrestante group, a new mine of silver-bearing magnetite, known as the Sol y Luna, is being opened. The only development work at present consists of a vertical shaft, which has been sunk during the last year to a depth of 162 meters.

About three miles to the northwest of Aranzan, the Mazapil Copper Co. is also operating the San Eligio and Salaverna mines, and still farther to the northwest, the Naranjera mine, at San Pedro. About 8000 tons of run-of-mine ore are produced monthly. The lead ores are now carried by cable to Bonanza and shipped from there to the company's lead smeltery, at Saltillo, Coahuila. The siliceous ore is being shipped to the Peñoles smeltery, at Mapimi.

The Naranjera mine is producing a siliceous ore carrying 20 to 30 oz. of silver, which is shipped to the Mazapil Copper company smeltery, at Concepcion del Oro. This smeltery has been operating from three to four furnaces during the year, producing a 45% copper matte, which is shipped to England for refining. The lead smeltery of the same company is running three large furnaces. About $25,000 of development work per month was done in the company's mines.

Adjoining the Mazapil properties and to the north are numerous other mines, large and small, which operated without disturbance in 1912. Chief of these is the Bonanza, a Guggenheim property, and the Albarradon, controlled by Mexican interests. Copper and lead-silver ores are the main products, all of which are now taken by cable to Bonanza and shipped to various smelters.

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Pachuca Operated Steadily in 1912

Special Correspondence

The estimated production of the Pachuca and Real del Monte mines for 1912, is 800,000 tons, of an average grade of 22 oz. silver and 0.1 oz. gold, the total average value of which was $15 per ton; about 88½% of this was recovered. These figures cover ore milled locally and treated in cyanide plants, the figures for high-grade ores shipped to smelters being unavailable and unimportant. The actual shipments of bullion for the first nine months of 1912 are shown in the accompanying table.

BULLION SHIPPED FROM PACHUCA DURING FIRST NINE MONTHS OF 1912

Shippers	Tons of 2000 lb.	Fineness Au.	Fineness Ag.	Contents in oz. Gold	Contents in oz. Silver
Santa Gertrudis	150	4.926	853.229	21,602	3,741,656
Real del Monte y Pachuca	150	4.548	826.542	19,867	3,610,032
San Rafael, and Sechbach	48	4.804	901.253	6,781	1,272,291
La Blanca	48	4.859	898.016	6,836	1,263,262
Maravillas y San Francisco	30	4.472	910.950	3,855	785,168
La Union	14	3.778	854.217	1,565	353,794
Purisima Grande	14	7.260	905.534	2,959	369,019
Blaisdell Coscotitlan Syndicate	13	4.632	863.063	1,717	319,873
Alfredo Islas	3½	3.409	741.800	347	75,286
Popolo Tailings Co	½	12.227	714.669	107	6,242
Totals or averages	471	4.778	858.821	65,635	11,797,332
Estimated average for year 1912	628	4.778	858.821	87,513	15,729,776

The Real del Monte company had its two mills in full operation, treating about 40,000 tons of ore per month. Santa Gertrudis, which is the only company that does not remove 15 or 20% of the valuable constituents of the

ore previous to cyaniding, treated about 23,000 tons per month, but the capacity is to be increased to 28,000 tons. The La Blanca company treated about 8000 tons per month, but this will be increased to 12,000. Reports indicate that a reduced production may be expected from the San Rafael company.

Two American companies, the Blaisdell Coscotitlan Syndicate and the Popolo Tailings Co., retreated by the cyanide process, the tailings which have accumulated during the last 150 years to the south of Pachuca. These tailings carry a fair amount of gold, owing to the low recovery of this metal obtained in olden times by the patio treatment of ores.

El Chico camp is showing signs of renewed activity on a limited scale, a small custom mill being in process of erection. The production of Pachuca district should reach its maximum during the coming year, and including concentrates should approximate 20,000,000 oz. of silver and 90,000 oz. of gold. The district has been practically unaffected by revolutionary troubles. Duties on mining and milling machinery and supply imports were increased 5%, Sept. 1, 1912, and were scheduled to be increased an additional 5% Jan. 1, 1913. These imports will add materially to equipment and operation costs in Mexico.

Mining at Parral

By Franklin W. Smith*

Parral suffered much inconvenience because of the revolution. In February, 1912, most of the foreigners sent their families to the United States. Soon after rail communication was severed and no rail or freight was received until late in March. During the first week in April the town was bombarded and captured by the rebels, who looted stores and levied on banks. The banks closed their doors and have not since reopened. Business was badly crippled. Most of the mines suspended operations.

Alvarado Company Operated Continuously

In the immediate vicinity of Parral, the Alvarado Mining & Milling Co. was the only company to keep going. Under the management of James I. Long, this company managed to eke out its supplies as they approached the vanishing point and not only to keep going but gradually to increase production. From the middle of April to the last week in May, Parral was accessible by direct line from El Paso, through Chihuahua, the railroad being operated by the rebels. During the second and third weeks of May, the federal general Huerta pushed Orozco's army back about 175 miles and gained possession of Jimenez, the point of junction of the Parral branch with the main line. The day before Orozco abandoned Jimenez the Parral garrison, fearing it would be left behind, mutinied, seized all available rolling stock and left the town. One or two bridges were destroyed and the town remained cut off until late in June. Since then rail communication with the United States has been maintained via Torreon and Eagle Pass. On Nov. 25 direct service to El Paso was resumed, but continued for only a week, when the rebels again tore up the line. At the end of 1912, the only company operating at full capacity was the Alvarado.

The Alvarado Mining & Milling Co. is operating four properties. The Preseña group, covering nearly a mile on the Veta Colorado, south of the Veta Grande mine, is developing successfully and opened good milling ore in the upper levels and also below water level, on the sixth and eighth levels. Some of the shoots carry high-grade ore, assaying 150 to 500 oz. silver. The ore of this vein contains no gold. This company is also operating Las Cruces mine, on the Cabadena-Las Cruces vein, 1½ miles south from Preseña, and one mile west from Palmilla Hill. The company owns 4000 ft. on this vein, which has only begun to be exploited. Water level is 100 to 250 ft. below the surface and the flow was sufficient to deter the operators of an earlier time. Active development and extraction have been going on above water level since July, and Las Cruces shaft has been unwatered preparatory to opening a new level in virgin ground. At the original Alvarado mine, in La Palmilia Hill, the upper levels were parceled out to lessees under the direction of a company superintendent. A considerable tonnage is bing won. At La Esperanza, on the east slope of Palmilla Hill, development was carried on to reach the Sangre de Cristo vein, the surface workings of which are giving good returns. Other veins on this part of the Alvarado ground are promising and are awating their turn for development. At present labor is exceptionally scarce.

The Alvarado mill is treating 8300 to 9000 tons per month. It has sixty 1150-lb. stamps, six 5x22-ft. tube mills, with Dorr classifiers, 3 Dorr thickeners and twelve 15x47-ft. Pachuca tanks. Wood is the fuel used in the power plant, to which fact has been due the company's ability to operate continuously during weeks when no freight could reach them. The outlook for 1913 is for increasingly successful development and for increased production.

The Veta Grande mine, of the American Smelting & Refining Co., on the Veta Colorado, near Minas Nuevas, is working on a small scale and shipping to the company smeltery. The Veta Colorado Mining & Smelting Co., north of the Veta Grande, shut down last spring and its 80-stamp cyanide mill is still idle. This company owns the Quebradillas claim, a famous producer in days past. Next to the north is Los Muertos mine, of the Sierra Plata Mining Co., which is being developed successfully; the stopes are said to be 15 sets wide in one place. Still further north the Terrenates mine is producing from an opencut, where the vein is nearly 100 ft. wide.

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Jalisco Experienced a Quiet Year

Austin C. Brady*

There was comparatively little rebel activity or brigandage in the state of Jalisco during the last year, and there was no direct interference with mining operations. However, generally disturbed conditions had an effect in this state as in all others of the Mexican union; in some instances work was suspended, and in others plants were greatly curtailed. No enterprise of importance was launched.

The Southern Pacific R.R. of Mexico built a 9-km. extension from Magdalena to La Quemada, thereby benefiting the majority of the Hostotipaquillo district mines. Extensions of the Etzatlan-Hostotipaquillo transmission lines of the Chapala Hydro-Electric Co. were built to the

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Casados and Cinco Minas camps. The Amparo Mining Co., of the Etzatlan district, made an average production of 140,000 pesos per month, the operating expenses amounting to half that sum. The company continued to disburse $60,000, in dividends quarterly. The mill now is treating 260 tons daily.

In the Hostotipaquillo district there was much activity. The El Favor mine, of the Makeever interests, was a steady shipper during the year, and the net returns were large. The El Favor mill was running on ores from the El Favor, Mololoa and Mirador mines, all Makeever properties. Much rich ore was shipped from the Mololoa and extensive development was carried on. The El Favor company declared a first dividend of 1c. per share, amounting to $35,000, payable Jan. 30, 1913. An option to purchase the Casados mines of the Consolidated Mining Co. for 4,500,000 pesos, held by American and French interests, was surrendered, due to general conditions in Mexico. Extensive and satisfactory development was done through the year, and shipments of high-grade ore were maintained. The Consolidated company will go ahead with plans for a reduction plant.

Only limited work was done by the Cinco Minas Co., controlled by the Marcus Daly estate, during the first part of 1912, but development now is being pushed, and construction preliminary to the erection of a 250-ton reduction plant is in progress. The company has a large tonnage of milling ore practically blocked out. The Espada Mines Co. leased the Virginia & Mexico reduction plant at the beginning of the year, improved it and now is milling 100 tons daily. Regular shipments of concentrates and bullion were sent out for several months. The Amajac Mines Co. worked on a limited scale during the year, and now is getting ready for a cyanide plant.

A promise by the National Rys. of Mexico to build a branch from Ameca to the Magistral camp, aroused mine owners of the Ameca district. The Magistral-Ameca Copper Co., which did little during the year, is planning to resume, and the Zapote group of mines, an organization that has the Zapote copper group under bond, and which stopped work several months ago, will again become active. The Almoloya Anexas company was a steady producer of concentrates in 1912, having doubled the capacity of its concentrating plant. La Union Mining Co. was organized several months ago to work the La Union copper mines, and has since been developing. The work of the La Regina Mining Co. during the year was limited.

The Mexican Mines Co., owning the old Bolaños mines, in the Bolaños district, suspended work early in the year, but now is resuming. The company spent 80,000 pesos on a wagon road, which is not yet completed. The El Tajo Mining Co., a Makeever enterprise, owning the old Tajo mines and a reduction plant in the San Sebastian district, operated steadily all the year. Due to general conditions, the Mexican Mining Co. did little at its properties, in the Tapalpa district. A 50-ton smelting plant was purchased, but was not erected. The Lupita Mines Co. worked in a limited way in the Mascota district. The Carrizo Copper Co. and the San Miguel Gold Mining Co. shut down several months ago.

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Central America in 1912

The mining industry in Central America was remarkably quiet in 1912. No new districts of promise were discovered, while several promising fields showed diminished activity.

Guatemala

In Guatemala the thorough exploration of the country undertaken by the Guatemala Mining & Development Co., in which Governor Sulzer, of New York, and A. E. Spriggs were interested, was practically completed and nothing of promise other than a marble deposit was discovered. Some work was done by this company, and by Minor C. Keith at the Concepcion silver mines, but with indifferent results.

The Chiantla Mining & Smelting Co. received a small lead-silver furnace, which is to be operated at the property, near Chiantla. The Potts & Knight placer property, at Las Quebradas, continued a steady producer as it has for the last 30 years. Numerous efforts have been made to dispose of this property to parties able to install modern machinery, which would materially increase the output.

Honduras

The New York & Honduras Rosario Mining Co. continued to be the chief producer with an output of $944,000 for 1912. A total of 39,258 tons of silver ore was treated. The new cyanide plant, having a capacity of 200 to 250 tons per day, went into commission in 1912. With the old equipment little ore running under $25 per ton was touched, while with the new plant the management claims that $15 ore will be the average for the next few years.

A concession was granted to Ricardo Strauber, late in 1912, to exploit the famous iron mountain at Agalteca. This concession, which was for a period of two years, carried with it a grant for the construction of a railway to communicate with the Atlantic Coast by way of the Sulaco Valley. This will open up the copper-gold district at Minas de Oro, the operation of which has been curtailed, due to lack of transportation.

Prospecting continued in the Department of Olancho, but no discoveries, other than small pockets of placer gold, were made.

A concession was granted to the Honduras Oil Co., of Ceiba, to exploit the petroleum fields on the Guare district. Various small mines were in operation in the Pacific Coast section of the country.

Salvador

The Butter's Salvador mine, at Santa Rosa and Divisidero mine, at La Union, were the chief producers of 1912. The output of the Salvador property continued at about $60,000 to $65,000 per month, with the Divisidero production at about $40,000 per month. The cyanide process is now in use at both plants. The ore reserves at the Butters properties are reported to be encouraging. The exports from Salvador during 1911 were as follows: Gold in bars, $760,413; gold and silver amalgams, concentrates, etc., $700,256; silver in bars, $160,702.

Costa Rica

The Abangarez Goldfields was the main factor in the mineral production of Costa Rica in 1912. The Boston mine was closed early in the year, however, and has not been reopened. The low recovery obtained at the Abangarez plant has resulted in numerous experiments and the system of treatment will doubtlss soon be changed. The new 2500-hp. hydro-electric plant was completed and work is well along on the new mill.

The new 100-ton addition to the cyanide plant at the Aguacate mines was to have been in operation by Jan. 1, 1913. The La Union slimes plant operated successfully in 1912. This company will show a substantial increase over 1911. R. A. Crespi, a pioneer in the mining industry of Costa Rica, is developing copper and manganese deposits on the west coast. During 1911 exports of gold and silver in bars amounted to $1,183,164.

Nicaragua and Panama

Mining in Nicaragua was at a low ebb in 1912. The revolution practically paralized the industry on the Pacific Coast, while in the Pis Pis district the Concordia, Bonanza and Lone Star were the only properties operating at the close of the year. A new mill is planned at the La Luz y Los Angeles mine, in the Cuicuinita district.

In Panama the Darien Gold Mining Co., Ltd., ceased operations at its property in Cana, pending a reorganization of the company. Panama exported $119,580 in bar gold during 1911, practically all of which came from Darien. In the province of Los Antos a Los Angeles company began the development of a copper prospect, while in the Veraguas section several placer gold claims were obtained by Nathan Hill. It is understood that an American company is about to acquire extensive petroleum interests in the republic.

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Mining in South America in 1912

Special Correspondence

The year 1912 saw notable advances in the mining industry of South America. American capital was much in evidence in connection with new developments, while English interests were also well represented. Copper mining and smelting bids fair to take a decided advance in the next few years. The Chilean fields have attracted much interest while the Cerro de Pasco region in Peru has steadily advanced. Large ore deposits of copper and other metals have been found on both sides of the Andes and much development work is now in progress. Bolivia continued as the chief tin producer, with slightly diminishing results. South America as a whole produced about $17,000,000 in gold during 1911 and the 1912 figures will show a substantial increase.

Argentina

The copper-mining industry of Argentina is chiefly centered in the district near Chilecito, Province of Rioja, which is the lowest terminus of the 22-mile Bleichert aërial tramway, built by the Argentine government. The principal mines have been acquired by the Famatina Development Corporation, Ltd., of London, and its subsidiary, the Forastera Mines, Ltd. Arrangements were made in 1912 to increase the smelting capacity.

La Concordia mine, in the territory of Los Andes, near San Antonio de los Cobres, carried on extensive development work. The mill has produced about 15,000 tons of concentrates running about 30% lead, 6% copper and 4400 grams silver. Power is generated from the falls in the Cerrillos River. Extensive railway development in Argentina stimulated the search for domestic coal and oil. The Rivadavia, Mendoza, Santa Cruz and Jujuy districts were the most active in 1912.

The mineral exports from Argentina in 1911 had a value of $545,551, and were as follows: Copper bars, 645 metric tons; copper ore, 1492 (the value of these two items is about 73% of the total); wolfram ore, 584; borate of lime, 576; onyx, 381; mica, 15; vanadium ore, 217; lead ore, 103 tons; while all else had a value of only $2516.

Uruguay

A geological survey of Uruguay, under the direction of Maurice A. Lamme, formerly instructor in mineralogy at Columbia University, was undertaken in 1912 in the efforts to stimulate the mining industry of the Republic.

An English company acquired titles to the Zapucay Mines and installed modern machinery. The French company operating at Corralles also disposed of its holdings to English interests. Extensive development work was done in 1912, the mill remodeled and a cyanide plant put in operation. The milling costs were from 7s. to 8s. per ton of ore treated.

Brazil

Brazil attracted unusual attention in 1912 in connection with the development of the iron deposits in Minas Geraes. The absence of suitable shipping facilities has hindered production up to this time, but a combination of the interests controlling the port, railway and mine, as reported in London in December, 1912, will remove this obstacle. Important deposits of manganese ore occur in Minas Geraes. The largest mine, the Morro, produced about 60,000 tons. The Brazilian ore carries an average of 50 to 53% manganese, 3 to 3.5% iron and 0.03 to 0.04% phosporus. All the Brazilian ore is exported. Manganese also occurs in the states of Bahia and Matto Grosso.

The diamond industry continued its usual activity during 1912. The production of the Ouro Preto Gold Mines, Ltd., an English company, was slightly curtailed by a shortage of labor. The average of the ore treated for the first six months of 1912 was just under 12 grams of gold per ton. An extraction of 92% was obtained. The St. John del Rey Mining Co., Ltd., has an estimated ore reserve of 1,000,000 tons. During the year ended Feb. 29, 1912, this company sent 192,600 tons of gold ore to the 120-stamp mill, recovering 29s. 9d. per ton, by amalgamation, and 16s. 1d. by cyanidation. The lowest working of this property is 4900 ft. below the surface. An American expedition arrived in September to test reported gold-dredging ground in the State of Goyaz.

The Guianas

The exports of gold and diamonds from British Guiana, from Jan. 1 to June 20, 1912, showed a decrease in value from a similar period in 1911. The gold exported during this period in 1912 was valued at $339,185,

as against $349,401 in 1911. A total of 1651 carats of diamonds, valued at $8758, was exported during the period in question during 1912, as against 1470 carats, valued at $15,225 in 1911. The principal diamond districts are on the Mazaruni River and at Devil's Hole on the Cuyuni River. Several English and American companies have been interested in the industry since its beginning in 1900, but with the exception of the Mazaruni Co., Ltd., of London, no systematic work has been carried on continuously.

The gold production was derived from placer workings and a few quartz properties. A new law went into effect in British Guiana taxing quartz properties on the basis of profits rather than on the ounces of gold produced. Alluvial gold continued to be the chief item of interest in the mineral production of French Guiana during 1912. The gold production of Dutch Guiana for the year ended Sept. 30, 1912, was 518,957 grams, a decrease of 157,629 grams from the previous year. This output came mainly from prospectors and a few companies operating both quartz and alluvial properties. There are two gold-bearing zones in Dutch Guiana, the one nearest the sea coast situated in the northwest district at the head of the rivers which flow into the Saramacca on the south and the Atlantic Ocean on the north, the dividing ridge being the Nassau Mountains. The second zone stretches across the country from northwest to southwest, beginning in the Corantyne and Nickerie Rivers, from thence to Saramacca across the Surinam to the Upper Sara Creek and across the Tappenanoi, Gonini and Maroni. During 1912 there were over 5000 laborers engaged in the several districts. Late in September an expedition arrived to prospect the alluvial property held by the Olga Exploration Co., Ltd., of London. Discoveries of vein and placer cinnibar on the Marowyne River were reported in 1912, but examinations made by American engineers were somewhat discouraging.

Venezuela

The mining law of Venezuela was modified late in 1912, depriving the land owner of his one-third share in the net profits on mineral deposits worked by persons who had obtained a legal concession of the mining rights under his property. This onerous privilege, coupled with the frequent changes of the mining law, has served to check all mining enterprise in Venezuela up to this time. The values of the chief mineral exports of the country were, for 1910 and 1911, respectively,: Gold, 1,604,553 and 3,337,886 bolivars;[1] asphalt, 948,876 and 1,386,184 bolivars; copper ore, 785,000 and 1,310,400 bolivars.

The iron mines at Imataca, controlled by the Canadian Ore Co., Ltd., of Montreal, began regular shipments in 1912. The analysis of the first cargo sent to Philadelphia showed 68.20% iron, 0.016% phosphorus, 0.042% sulphur, 1.40% silica and 0.231% titanic acid. The ore is a hard hematite. The mines are located south of the Orinoco River, about 75 miles from its mouth. A power house and electric plant have been installed and over 10,000,000 tons of ore developed.

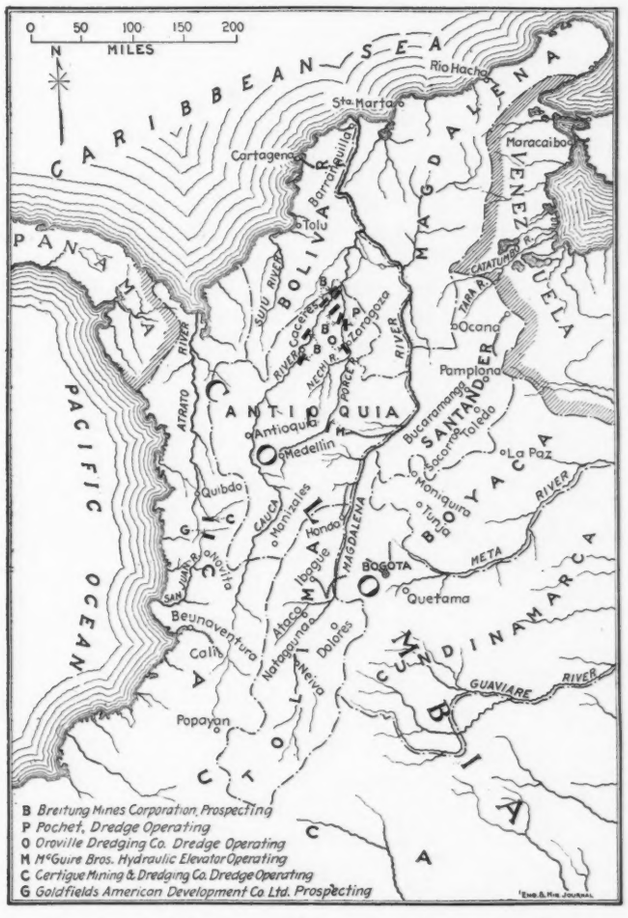
The South American Copper Syndicate, of London, opened the Oroa group of mines which were worked by the Quebrada company, an English concern. The Gold Fields of Venezuela, an English company, extended their holdings in 1912 and brought in considerable equipment. A French company opened the La Experiencia mine between El Callao and Guasipati, where rich discoveries were reported.

Extended explorations for oil and gas are being conducted by the New York & Bermudez Asphalt Co. The Republic has been divided into 12 districts and an American engineer assigned to the work in each.

The Venezuelan Oil Fields, Ltd., of London, did considerable drilling at Manicuare, on the Peninsula of Aroya, in the State of Sucre. The Caribbean Coal Co. holds extensive bituminous coal lands in the Peninsula of Guagira, Paez district, State of Zulia, which are to be developed during the coming year.

Colombia

The chief interest in Colombia lies in the alluvial deposits of gold in the valley of the Magdalena, and of



Colombia, Showing Principal Alluvial Gold Operations

gold and platinum in the valleys of the Atrato and the San Juan. Two dredges were in operation in 1912, the "Pochet," a 3-cu.ft., Worth-Conrad steam-driven boat on the Nechi, a tributary of the Magdalene, and the "Certigue," a 5-cu.ft., steam-driven Empire dredge on the Certigue River, a tributary of the Atrato above Quibdo. The Oroville dredge and hydroelectric plant were to be delivered to the Oroville Dredging Co. by the Yuba Construction Co. in December, 1912, and the dredge was scheduled to commence digging by Jan. 1, 1913. This dredge has an 8-cu.ft. bucket and is electrically driven.

[1]One bolivar equals 19.3c.

The Breitung Mines Corporation has options on several tracts on the Cauca and Nechi Rivers, and did considerable drilling in 1912. Lewisohn Brothers prospected an area in the Atrato Valley early in 1912, but evidently with unsatisfactory results.

The Gold Fields American Development Co., Ltd., sent out a large party late in 1912, to drill several claims near Novita, on the Condoto River, a tributary of the San Juan. Two other drilling parties representing American capital expect to commence operations on the Nechi and Cauca Rivers early in 1913.

On the upper Porce River, the McGuire Brothers operated an Empire hydraulic elevator with encouraging results. The Guadaloupe and Porce Mining Co., composed principally of Denver, Colo., men, was reported to have installed an Evans hydraulic elevator.

El Recreo mine, in the department of Tolima, produced 860 oz. of bullion from Sept. 1, 1911, to Aug. 31, 1912. This mine has a wooden stamp mill of nine stamps. The ore treated was all from development work.

In the southern part of the republic, near the boundary of Ecuador, are several gold quartz mines, which report encouraging operations. Here the Gualcala Mines Co., an American concern, operated an all-sliming cyanide plant in 1912. The chief source of platinum was in the Choco country, between the Atrato River and the Pacific coast. Practically the entire output of this metal was won by natives using primitive methods.

Representatives of Gov. Sulzer, of New York, and A. E. Spriggs, are reported to have been active in 1912 in the search for coal and oil lands in Colombia and Venezuela.

A large portion of the emeralds mined in the world come from the Muzo and Cosquez districts, about 75 miles north of Bogotá. The estimated yearly output of the Muzo mines is: First class, 263,000 carats; second class, 470,000 carats; third class, 23,000 carats; fourth class, 16,000 carats. The mines are under lease from the Colombian government to the Colombian Emerald Co., Ltd., of London, but about three years ago the government brought suit which has resulted in the holding of the entire production pending settlement.

Ecuador

Ecuador continues as the least known and least developed of South American countries on the Pacific coast. At present the only important gold-mining operation belongs to the South American Development Co., an American corporation. It is understood that the company operated throughout 1912. The West Coast Gold Dredging & Rubber Co. proposes to erect two dredges on their property in the northern part of the Republic during 1913. One near the mouth of the Cachadi River and one further up the river, near San Jose.

The Zaruma mining district, the development of which has been checked, due to lack of transportation, will be tapped by the railway from Machala to Loja, the concession for which was granted in 1912. The government has arranged to work the Payana salt mine and similar mines on other islands of the province of El Oro. Lignite of good quality was discovered in quantity near Quito, and the deposit is being developed for domestic consumption.

Peru

In the production of copper, the Cerro de Pasco Mining Co. continued to be the dominant interest. Basic converters were installed by the Cerro de Pasco Co. and studies made with a view of developing hydro-electric power near Oroya for the mines and smeltery.

The Backus & Johnston smeltery, at Casapalca, increased their capacity to about 800,000 lb. of copper matte per month, and another new furnace is about to be installed.

The development work on the large low-grade copper deposit at Ferrobamba, Cuzco department, was pushed by an American group headed by A. C. Burrage, of Boston. When sufficient development has been done the company proposes to construct a railway to connect with the Southern.

Arrangements are reported to be under way for the blowing in of the Rio Blanco smeltery, which was purchased in 1912 by E. E. Marshall, of Lima. The plant was built by the Peruvian Mining, Smelting & Refining Co., in 1908, but on account of the difficulty in obtaining the components for the smelting charge it was impossible to operate at a profit. These difficulties have now been overcome to some degree.

The cyanide process was introduced in the gold region of Peru in 1912 at the new mill of the New Chuquitambo Gold Mines, Ltd., near Cerro de Pasco. The 40-stamp mill and cyanide plant made a monthly output of about 29 kg. of bullion from 3000 tons of ore. The copper present in the ore resulted in a high cyanide consumption and some details of the process are to be changed to overcome this trouble.

The first clean-up was made by the Aporoma Goldfields, Ltd., during 1912. The dry season early in the year interfered with this hydraulic operation, but results for the year were satisfactory.

The Inambari Gold Dredging Concession, Ltd., of London, has raised the necessary capital to continue its work with the large dredge completed in 1912. The Peru Pot-Hole Gold Co., operating on the upper Maranon River, is to install a hydraulic plant in 1913.

The Caylloma silver mine, in Arequipa, maintained a steady production in 1912, and a cyanide plant is planned for the near future. The ore averages from 600 to 800 grams of silver per ton, and the present recovery is about 60%. E. E. Fernandini produced about 1,500,000 oz. of silver in his Huaracaca smeltery. The Doceña mine, at Cerro de Pasco, shipped about 8000 tons of silver ore per month to the local smeltery.

The most important deposit of vanadium in Peru is situated at Minàsragra, in the Cerro de Pasco district. On calcination the ore averages about 40% vanadic acid. The property is owned by the American Vanadium Co., of Pittsburgh. Shipments to the United States in 1911 were valued at $38,011.

The exploitations of oil in Peru during 1912 were confined to the most part to the northern zone, where the London & Pacific Petroleum Co., Lobitos Oil Fields, Ltd., and Fustino G. Piaggio & Co. worked the deposits of Negritos, Lobitos and Zorritos, respectively. The Lagunitas Oil Co. also worked on the oil lands of the London & Pacific Co., to whom the oil was sold at a fixed price.

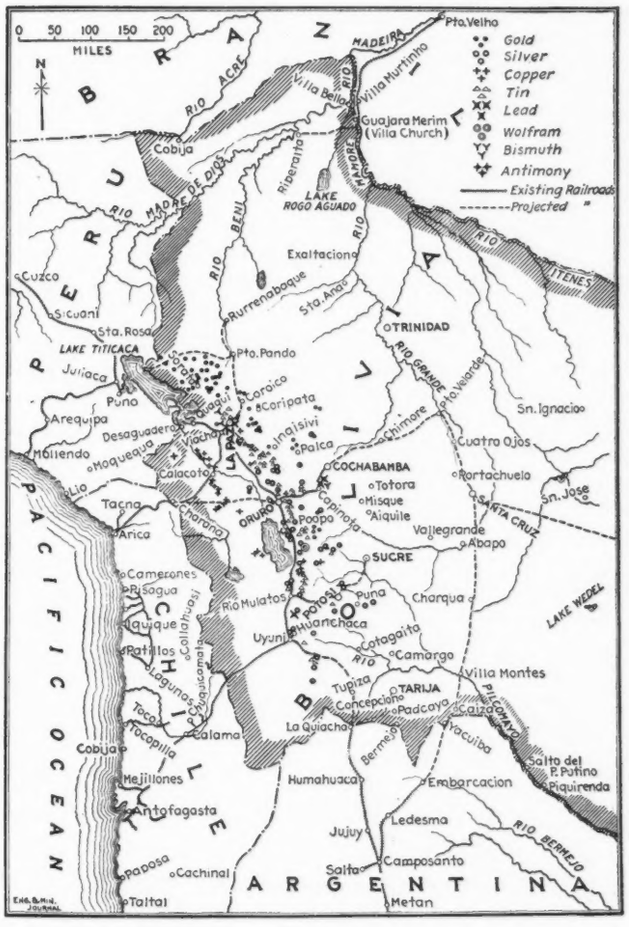
The output in 1911 was approximately as follows: Negritos and Lagunitas, 128,000 metric tons; Lobitos, 60,000; Zorritos, 12,000 metric tons. There are two refineries in Peru. The Talara, belonging to the London & Pacific Co., and the Zorritos, owned by Fustino Z.

Piaggio & Co. A large tank for the storage of fuel oil was erected at Callo for the storage of Peruvian oil destined for the use in the nitrate fields of Chile. Some of the mining companies in Peru converted their boilers for the use of fuel oil during 1912.

The coal mines of Gollarisquisca were the greatest producers in 1912. This coal was used on the Cerro de Pasco R.R. The mines of Quishuarcancha also increased their production. Much interest was shown in the new district of Oyon, where the coal is of a good coking variety.

Bolivia

The exports of Bolivia tin-ore concentrates (estimated at 60% metal) during the first nine months of 1912 were 27,783 metric tons. The first six months of 1912 showed



Bolivia, Showing the Mineral Distribution

a decrease of about 282 metric tons as compared to a similar period in 1911, and it is considered doubtful whether statistics of the latter half of 1912 will show a compensating improvement in spite of the prevailing high price of tin and the steadily improving traffic conditions. The explanation is to be found in the internal condition of the industry. Local resources are employed almost exclusively and immigration of labor to Bolivia is out of the question. Mechanical appliances, especially rock drills, are being introduced on a larger scale than previously, and the tonnage crushed is being increased. But as a lower grade ore is being handled generally, there is no corresponding increase in the production. As a rule, also, the best patches of the richest mines have been exhausted and are not easily replaced. At the Aramayo Francke mines the limit of the local resources has been reached with 2500 men, and unless they further increase the output per man by the installation of more rock drills, an increase in production is doubtful. The only producers of bar tin worth mentioning at present are Messrs. Soux, Hernandez & Co., in Potosi, and with the advance of the railway they will probably export the whole of their production as *barrilla,* as they already do with two-thirds of their output.

In the Corocoro copper district, two companies were active in 1912, the Compañia Corocoro de Bolivia, a Chilean concern, and the Corocoro United Copper Mines, Ltd. The greater part of the bismuth supply of the world came from the Bolivian mines during 1912. Aramayo Francke Mines, Ltd., is one of the largest producers. These mines produce about 170,000 kg. of crude bismuth per year. During the year ended May 21, 1912, its output fell off about 33,750 kg., but from June to October there was an increase of 37,100 kilograms. Alluvial gold deposits continue to receive marked attention, and several concessions were granted to American companies. The Tipuani rush continued well into 1912, much to the regret of the unfortunate prospectors. Petroleum deposits have recently been discovered in Bolivia and a company was organized in Sucre to develop the deposits in the Province of Acero.

The Bolivian exports in 1911 were: Tin (*barilla,* 60%), 37,073 metric tons; bismuth (*barilla,* 50%), 415; bismuth ore, 141; copper (*barilla,* 80%), 2950; zinc, 9798; wolfram, 297; antimony, 312; iron, 331, and mercury, 340 metric tons; silver bars, 4,587,745 bolivianos[1]; gold ore, 94,906 bolivianos.

Chile

Much development was done in Chile in 1912 and more American capital invested in mining. The converters of the Braden Copper Co. were started on Jan. 15, 1912. This company experienced a successful year, and the flotation experiments conducted indicated a more economical treatment than the gravity system of concentration previously installed.

The Chile Exploration Co., a Guggenheim subsidiary, prospected the copper deposits at Chuquicamata by means of churn drills and underground work. The Central Chile Copper Co., near Coquimbo, was active, smelting operations being increased by the opening of numerous small mines in the district.

For the fiscal year ended June 30, 1912, the nitrate exports amounted to 2,454,000 metric tons, valued at $95,767,058. A government auction of nitrate lands was held early in December. Tin was discovered in the Province of Atacama and small shipments made. The Chilean government continued its work of prospecting for new coal and oil deposits, with fair results. The coal production for the first half of 1912 was 66,170 tons, with a decided increase indicated during the latter half of the year. The work of mapping the iron deposits of the country was also pushed, 100,000 pesos having been appropriated for this purpose. The Chilean mineral exports for 1911 were as follows: Borate of lime, 44,508 metric tons; copper, 23,287; copper ore, 63,769; copper and gold ore, 3489; iron ore, 28,600; nitrate, 2,454,000 tons, and iodine, 437,488 kilos.

[1]One boliviano = 39c.

Mining in the Transvaal in 1912

By H. F. Marriott*

The year 1912 provided a new high record in the production of gold from the Witwatersrand area, the increase over 1911 amounting to no less than £3,600,000, while the tonnage crushed showed an increase of approximately 1,500,000. It is extremely gratifying to observe that the downward tendency of yield per ton which has been in operation ever since the war (1899-1902) has received a check, the yield per ton amounting to 29.4s., an advance of 1.3s. on the 1911 figure. This yield is in fact better than that of any year since 1908.

General Technical Progress

The general tendency to meet the increasing scale of underground operations is toward the installation of comprehensive schemes of mechanical transport underground which connect the various sections of each mine by one main artery with the principal loading station at each main shaft. This insures fuller efficiency of the hoisting arrangements and does away with the congestion of traffic in the immediate locality of the more active operations.

Greater attention was paid in 1912 toward mining to a clear profit and this was reflected in a higher yield and consequent higher profit from those mines in which the policy was actively adopted.

No new producers came into the list during the year and the increased tonnage and yield are therefore all the more noteworthy. The duty per stamp again showed a marked increase, from 7.8 tons per day in 1911 to 8.5 tons per day at the close of 1912. In two years the average increase has amounted to about 20%. This, of course, does not indicate the progress made in crushing duty in new plants as compared with old ones, as the figures quoted include all the plants at work.

The Salisbury Mine

The year saw the passing of the Salisbury mine, one of the earliest producers on the fields, which commenced operations in 1887. Although the total area of this mine only amounted to about 20 claims, it has produced profits sufficient to pay dividends totaling 405% on a capital varying from £16,000 to £135,000, the total sum so distributed amounting to £248,823.

Benoni Cyanide Plant Disappointing

Considerable disappointment was experienced during the year by the failure of the new plant at the Benoni mine to come up to expectations. The cyanide portion of this plant was in some respects rather in the nature of an experiment, sands and slimes being treated together by a continuous process, and it was this portion of the plant which failed to fulfill the estimate made of its capabilities. It is stated that the screw elevators failed to transfer satisfactorily the settled pulp in the dewatering cones, thus necessitating an alternative scheme being put in operation, the delivery of a different class of product and the consequent disorganization of the remainder of the scheme of treatment. Extensive alterations and additions were recommended, but the company was not in a position to meet the extra cost involved, and the plant was shut down after running seven months.

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Metallurgical Equipment and Processes

The four Nissen stamps mentioned in last year's article have given satisfaction, and have been accepted as a regular part of the City Deep stamp-mill equipment. These stamps are stated to require 30% less power than the original City Deep stamps for the same tonnage crushed.

The Giesecke ball mill, of which a trial was made in 1911, did not prove a success and was not adopted on these fields.

The Merrill zinc-dust process, of which I made mention last year, has proved a pronounced success in certain reduction plants where the slime solutions are comparatively strong, but in cases where the solutions are very dilute the process has not shown an advantage over zinc shavings.

Sand Filling

The filling of worked-out stopes with sands, which was inaugurated in 1910, was continued with vigor at many of the mines, with beneficial effects upon the stability of shafts and workings. The Ferreira Deep in particular may be quoted to indicate the progress made. Up to the end of September, 750,000 tons had been sent down this mine at a cost of about 1s. 3d. per ton. The usual practice is to run the sand down the mine mixed with water, but at the Cinderella Consolidated where the great length of vertical pipe in the shaft resulted in excessive wear and tear of the pipes, a method was installed of dropping dry sand through a vertical wooden-box launder, and commencing the water-borne system at the foot of the shaft. It is stated that with the moderate amount of filling in this mine, the new method is meeting with success.

TABLE I. TRANSVAAL GOLD PRODUCTION

	Witwatersrand District			Outside Mines	
Year	Tons Milled	Value	Value per Ton Milled Shillings	Value	Total Value for Transvaal
1884-89	1,000,000	£2,440,000	48.83	£238,231	£2,678,231
1890	730,000	1,735,491	47.4	134,154	1,869,645
1891	1,154,144	2,556,328	44.2	367,977	2,924,305
1892	1,979,354	4,297,610	43.3	243,461	4,541,071
1893	2,203,704	5,187,206	47.0	293,292	5,480,498
1894	2,830,885	6,963,100	49.2	704,052	7,667,152
1895	3,456,575	7,840,770	45.2	728,776	8,569,555
1896	4,011,697	7,864,341	39.2	739,480	8,603,821
1897	5,325,355	10,583,616	39.74	1,070,109	11,653,725
1898	7,331,446	15,141,376	41.3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48.84	661,220	15,728,693
1900	459,018	1,510,131	65.82	.....	1,510,131
1901	412,006	1,014,687	49.25	81,364	1,096,151
1902	3,416,813	7,179,074	42.00	74,591	7,253,665
1903	6,105,016	12,146,307	39.79	442,941	12,589,248
1904	8,058,295	15,539,219	38.46	515,590	16,054,809
1905	11,160,422	19,991,658	35.82	810,416	20,802,074
1906	13,571,554	23,615,400	34.8	964,587	24,579,987
1907	15,523,229	26,421,837	34.04	981,901	27,403,738
1908	18,196,589	28,810,393	31.6	1,147,217	29,957,610
1909	20,543,759	29,900,359	29.1	1,025,429	30,925,788
1910	21,432,541	30,703,912	28.5	1,297,823	32,001,735
1911	23,888,258	33,543,479	28.1	1,498,006	35,041,485
1912 (estimated)	25,350,000	37,220,000	29.4	1,580,000	38,800,000

Gold Content at Depth

An attempt was recently made to revive the old controversy as to the decadence of value of the reefs on the Rand with depth. As if to confound the adherents to this theory, almost simultaneously the news arrived that

in the 19th level of the Village Deep, the Main Reef Leader had been cut and had returned an average assay of 54s. over 39 in., a figure well above the average of the mine above. This level is the lowest point reached in the mine, the vertical depth being about 4100 ft., and the lateral distance from the outcrop about 7000 feet.

Eastern Section

Perhaps the most noteworthy general feature of 1912 was the development of the far-eastern section of the Rand. Up to a few years ago this area, with the exception of one or two established mines, was looked upon with some disfavor as being highly speculative and much poorer than the main portion of the Witwatersrand. It has now become alive with expansion and progress.

The New Modderfontein has developed into one of the foremost mines of the Rand, with a declared monthly profit of nearly £50,000, and a reserve of developed ore amounting to 4,000,000 tons, containing gold to the amount of 34s. per ton. The Brakpan, which commenced crushing in May, 1911, is now declaring profits of over £40,000 per month, with an average profit per ton crushed of about 14s. 3d. The Modderfontein B commenced crushing operations in November, 1911, and the profit declarations are about £30,000 per month, a return considerably in excess of all early estimates of the value of the mine. The Geduld has not gone ahead so fast, but from a monthly average of £2900 during 1911, it increased its profits to nearly £5000 per month. These four companies in 1912 produced a gross profit of approximately £1,400,000 from a tonnage milled of about 1,730,000, or an average of 16s. per ton.

In addition to the above properties, developments were pushed on the Modderfontein Deep Levels and the Government Gold Mining Areas (Modderfontein), and both companies struck the reef during the year, the former with excellent assay values. The Springs Mines are also putting down two shafts and expect to reach the reef shortly. To the east of the properties mentioned there is a fairly large area of reef-bearing ground, but so far no proof has been forthcoming that any portion of it will turn out to be profitable.

The government announced it is prepared to receive applications for the lease of 2535 claims to the south of the Brakpan and the Government Gold Mining Areas (Modderfontein) Consolidated, to be worked either as a separate company or in conjunction with another area. The conditions of purchase appear to be somewhat more favorable to the lessee in the higher grades of profit, but published opinions express considerable doubt as to these coming into practical operation.

Mine Labor

The efforts which the various groups have been making for some time past to abolish the evil of indiscriminate competition in the recruitment of native labor has resulted in the formation of a new organization, to control the recruiting on coöperative lines of all the mining groups on the Rand, with one exception. This organization has not yet been sufficiently long in existence to show what effect it will have upon the labor supply and its cost.

The number of natives in employment in 1912 was slightly in excess of the previous year; the highest point was reached in April when 215,000 were in the service of Transvaal gold mines. The number of whites employed has varied little during the last three years.

Complete mortality statistics are not yet available for the whole year, but such records as are obtainable show

TABLE II. LABOR EMPLOYED IN TRANSVAAL GOLD MINES
(Mines Department Statistics)

		White	Colored	Chinese	Total Colored and Chinese
1902	July	8,162	32,616	.....	32,616
	Dec.	10,292	45,698	.....	45,698
1903	June	11,815	66,221	.....	66,221
	Dec.	12,695	73,558	.....	73,558
1904	June	13,413	74,632	1,004	75,636
	Dec.	15,023	83,639	20,885	104,524
1905	June	16,939	104,902	41,340	146,242
	Dec.	18,159	93,831	47,267	141,098
1906	June	17,959	90,882	52,352	143,234
	Dec.	17,495	98,156	52,917	151,073
1907	June	17,166	111,862	51,517	163,379
	Dec.	17,697	129,618	37,118	166,736
1908	June	18,181	147,557	21,460	169,017
	Dec.	19,005	164,826	12,275	177,101
1909	June	21,620	175,895	6,317	183,212
	Dec.	23,077	168,665	2,038	170,703
1910	June	24,794	201,770	.....	201,770
	Dec.	25,376	191,784	.....	191,784
1911	June	25,960	106,197	.....	206,197
	Dec.	25,108	194,286	.....	194,286
1912	June	24,885	208,537	.....	208,537
	Sept.	24,221	195,993	.....	195,993

a gratifying reduction in the death rate from disease among the natives employed on the Rand. The accompanying table shows the steady decrease in the mortality rates which has taken place since 1903. The figures give the death rate from accident and disease combined among the natives employed by members of the Witwatersrand Native Labor Association:

TABLE III.—MORTALITY AMONG NATIVE MINERS ON THE RAND

Year	Death rate per 1000	Year	Death rate per 1000
1903	80.93	1908	35.81
1904	48.29	1909	37.72
1905	51.11	1910	35.72
1906	38.54	1911	31.01
1907	36.75	1912 (12 mo. ended Sept. 30)	28.63

Miners' Phthisis

In June, 1912, an act was passed by the Cape parliament to "make provision for persons who have contracted miners' phthisis, and for other purposes incidental to that disease." The act, which came into force in August, provided for the establishment of two funds: (1) A compensation fund for the payment of benefits to persons becoming entitled thereto during the first two years of the act; and (2) an insurance fund for payment of benefits accruing thereafter. Toward the first fund the government contributes £100,000 and the mines have to pay such sums as are levied in order to meet the claims allowed.

The following contributions have to be made to the second fund in respect of each underground employee: During the first two years, the employer contributes a sum equal to 2½% of the employee's earnings and the employee 2½%. Thereafter, the employer 5% and the employee 2½%. The benefits are to be paid to men who have contracted miners' phthsis and who have been employed underground for a period equal to two years during the four years preceding the date of the claim, but this time stipulation may be waived by the board set up by the act. The amounts to be paid are: (*a*) Eight pounds per month for one year to miners who show physical signs of the disease, but whose capacity for underground work is not seriously or permanently impaired. (*b*) Eight pounds per month, with a limit of £400 in all, to those who have contracted miner's phthisis in a marked degree and whose capacity for underground work is seri-

ously and permanently impaired. The board has the discretion to extend the period of payment so that the limit of £400 is exceeded. (*c*) In case of death, such sum as the board may decide, not exceeding £400, to the dependents of the deceased miner.

Compensation to native laborers is, under the provisions of this act, made on the same basis as those previously in force under the Native Labor Regulation Act of 1911.

A great deal of attention was given in 1912 to means for preventing miner's phthisis, and the use of water-spraying devices of various kinds largely increased. Ventilation, also, was improved at many mines and a considerable number of large fans were installed. The Minister of Mines in the early part of the year appointed a committee of engineers, doctors and others (known as the Miners' Phthisis Prevention Committee) to inquire into and report upon the improvement of methods for preventing the disease in the Witwatersrand gold mines, and to advise on a systematic and uniform policy for combating the evil. The final report of this committee is not yet issued, but a preliminary report was made containing recommendations for allaying mine dust by a comprehensive system of water sprays.

It is greatly to be hoped that all these efforts will lead to a great reduction both in the number of cases and in the virulence of the disease.

Diamond Mining

The Premier mine continued to be the only important producer of diamonds in the Transvaal. This company does not publish details of its production month by month, but the figures for 1912 have been estimated from the best information obtainable. The demand for diamonds has continued good and the production of diamonds, which fell off somewhat in 1911, as compared with the previous year, is estimated to be in 1912, 230,000 carats more than in 1911, while the price obtained was probably about 18s. per carat as compared with 16s. 2d. in the previous year.

TABLE IV. PREMIER (TRANSVAAL) DIAMOND MINING CO. LTD.

Year ended Oct.31	No. of loads washed	Number of carats found	Value of diamonds £	Yield per load in carats	Value per carat s. d.	Value per load s. d.	Cost of produc- per load s. d.
1903..	76,931	99,208	137,435	1.29	27:8.5	35:6.7	4:7.2
1904..	939,265	749,653	866,030	0.798	23:1.2	18:5.3	2:7.62
1905..	1,388,071	845,652	994,687	0.609	23:6.3	14:4.0	3:3.4
1906..	2,988,471	899,746	1,277,739	0.301	28:4.8	8:6.6	3:5.7
1907..	6,538,669	1,889,986	1,702,631	0.290	18:0	5:2.5	2:4.0
1908..	8,058,844	2,078,825	1,536,720	0.258	14:9.4	3:9.75	1:10.2
1909..	7,517,793	1,872,136	1,172,378	0.249	12:6.3	3:1.4	1:11.4
1910..	9,331,882	2,145,832	1,496,641	0.230	13:11.4	3:2.5	2:0.5
1911..	8,325,272	1,774,206	1,433,970	0.213	16:2	3:5.3	2: 2.60
1912*.		2,006,000	1,810,000	.....	18:0	.....	.....

*Estimated.

Coal Mining

The number of producing collieries was increased from 29 in 1911 to 32 in 1912, and the production was also slightly increased. About 4,750,000 tons of coal were sold in 1912, as compared with 4,340,000 tons in 1911. The price obtained for the coal at the pit's mouth, however, was slightly less or approximately 4s. 6d. per ton as compared with 4s. 8d. in the previous year.

Tin

The production of tin showed a slight falling off, with an estimated tonnage of 3135 as compared with 3525 in 1911. The higher price obtained in 1912 practically counteracted the loss in production and the estimated value of the yield was £390,000, as against £410,000 in the previous year.

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Mining in Rhodesia

By Hugh F. Marriott*

So far as production of gold is concerned the results of 1912 did not show any marked advance. The tonnage treated is in fact slightly less than that of the previous year, but the average per ton has advanced from 33s. to 35s. 5d., and the total yield shows a slight increase.

The number of individual producers of gold totaled in the latter part of the year 175, an increase of 12 over 1911. Out of this total, 89 crushed about 10,500 tons per month or an average of under 120 tons per month each. Only six mines crushed 5000 tons or over per month. The biggest producers were the Lonely, the Globe & Phœnix, the Giant and the Eldorado, which together were responsible for about 40% of the total production of gold.

The Globe & Phœnix maintained its position as the leading producer in Rhodesia. In 1911 71,802 tons were crushed, yielding £487,830 or £6 15s. 10d. per ton, and the net profit for the year after deducting all administration charges, depreciation, etc., amounted to £321,293, or £4 9s. 6d. per ton. During the first half of 1912, 33,824 tons were milled, yielding £243,287 or £7 3s. 10d. per ton, and the mine profit amounted to £182,150 or £5 7s. 8d. per ton. Making an allowance for administration and other charges on the same basis as in 1911, the net profit works out to about £158,000 or £4 13s. 5d. per ton. The total development at June 30, 1912, was 179,400 tons, of an estimated average value of £7 9s. 6d. per ton, a slight reduction in value as compared with the position at Dec. 31, 1911. A new sands plant was completed near the end of the year.

Although there were no noteworthy additions to the ranks of producing mines, a large amount of work was done on a few developing mines.

TABLE I. GOLD PRODUCTION OF RHODESIA

	Tons Milled	Value of Gold Won, £	Value per Ton, s.
Prior to Sept. 1, 1908	*	23,456	.....
Sept. 1, 1898 to June 30, 1890	81,841	177,072	43.26
July 1, 1899 to June 30, 1900	104,746	208,877	39.88
July 1, 1900 to March 31, 1901	140,716	320,457	45.54
Year ended Mar. 31, 1902	249,667	640,661	51.32
Year ended Mar. 31, 1903	338,156	709,461	41.96
Year ended Mar. 31, 1904	516,747	845,359	32.71
Year ended Mar. 31, 1905	787,936	1,113,068	28.25
Year ended Mar. 31, 1906	1,100,609	1,556,741	28.28
April 1, 1906 to Dec. 31, 1906	1,051,908	1,531,481	29.10
Year 1907	1,610,875	2,178,886	27.05
Year 1908	1,819,230	2,526,006	27.77
Year 1909	1,807,771	2,623,785	29.00
Year 1910	1,669,874	2,568,198	30.75
Year 1911	1,603,478	2,647,896	33.02
Year 1912 (Est.)	1,547,000	2,742,000	35.44

*No details available.

*Mining engineer, London Wall Bldgs., London, E. C., Eng.

During the nine months ended Sept. 30, 1912, the ore reserves of the Cam & Motor mines were increased from 607,664 tons, with a gold content of 46s., to 930,766 tons, containing gold to the value of a little over 45s. per ton. A 500-ton reduction plant was ordered.

At the Falcon Mine, where the ore contains gold and copper, the tonnage developed during the year to June 30, 1912, amounted to 311,000 tons, estimated to contain gold and copper to the average value of 58.4s. per ton. It was also estimated that further reserves amounting to about 330,000 tons were developed during the last half of 1912 but the value is not stated. The total reserves at Dec. 31, 1912, are estimated to amount to about 960,000 tons. A plant capable of treating 500 tons of ore per day is in course of erection.

At the Shamva mines, during the year ended Sept. 30, 1912, the ore reserves were increased from 1,554,761 tons, containing gold to the average value of 19.7s. per ton, to 2,203,912 tons, containing gold to the estimated total value of £2,323,513 or an average of 21s. per ton.

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Mining in Australia in 1912

By W. P. Geary*

In Australia, 1912 was a year of steady progress, and while it is not yet possible to obtain the output of the various metals accurately, it may be safely said that the production of the industrial metals will exhibit a large increase over 1911. The value of the minerals, other than gold, won in New South Wales and Queensland alone during the first nine months of 1912, exceeded that for the same term in 1911 by about £2,233,604. The year was not free from labor troubles, and in many centers operations were considerably hampered, but generally work proceeded steadily and systematically.

Gold

A steady decline in the gold yield continues, the accompanying comparative statement showing the position of the industry in the several states. The value of the gold production for the first 10 months of 1912 is estimated at £9,298,000. The yield furnished by Western Australia is substantial evidence of the magnitude of operations in that state. However, the steady drop in the average value of the ore won, and the fact that no new mines of importance are being opened, are matters of moment, considering the future of the industry.

In the eastern states, no results of any consequence were obtained, while the activity manifested in the other branches of the industry was the means of attracting the gold miners, and, consequently, prospecting was comparatively neglected.

In Victoria, which ranks next in importance to Western Australia as a gold producer, the yields from the established fields, such as Bendigo and Ballarat, fall considerably below the average of previous years. The decrease is not so pronounced in the case of Queensland, and the augmented production of the industrial metals makes up for the deficiency. The lessened yields from the Charters Towers and Gympie fields are mainly responsible for the shortage, and it would appear hopeless to expect any improvement under present conditions.

In New South Wales the yield is gradually diminishing, due in no small measure to the disappointing returns from the dredges. In the Cobar district, the principal center of gold mining in the state, the mines controlled by Great Cobar, Ltd., were vigorously worked, and the production for 1912 will, no doubt, show a considerable advance on that of the previous year. The output from the other fields was on a lessened scale.

Tasmania and South Australia also exhibit a drop in the output when compared with that of previous years.

The Dominion of New Zealand also records a lessened production, due to a cessation of operations at the Waihi mine through labor troubles, which have existed for the last six months or more. However, it is expected that matters will be righted shortly, when this famous mine will once more take its place among the active producers.

Silver and Lead

In New South Wales the Broken Hill field was the scene of great activity, and the mines could not get enough men to raise and treat what the managements desired.

The returns for the first nine months indicate that the value of the output from this state for 1912 is certain to be the largest in its history. The value of the production for the period mentioned exhibits an increase of £877,310, compared with the same period in 1911, and is substantial evidence of the headway which has been accomplished. Operations on the Yerranderie field were prosecuted with great vigor, and it is certain that the final returns will exhibit a marked advance on those of 1911. A prosperous year was experienced in Queensland, and the output of minerals for the nine months of 1912 shows an increase of £398,686 over that period in 1911.

Zinc and Copper

The production of zinc ore was well maintained, but the output of spelter was much restricted, owing to the great scarcity of labor.

It will probably be found that the Commonwealth produced approximately 48,000 long tons of copper in 1912. If this anticipation is realized, then the year will be a record one for Australia. So far 1907, with 46,000 tons, holds that honor, when electrolytic copper went to over £115 per long ton. It is not suggested by this that Australia rapidly takes to copper mining as the price of the metal moves up. The tonnage produced in 1907 was the outcome of a gradually extending movement in the direction of mining the industrial metals as opposed to the winning of gold and silver. If we go back a decade we find that in 1902 Australia's production of the red metal was only 28,600 tons. At the time of writing, Australia has nearly doubled her winnings. Statistics will probably prove that there are no more men engaged in the industry today than there were 10 years ago, which suggests, of course, that the increase has been brought about by the treatment of higher-grade ores.

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It could be said that the increased production when compared with 1902 was attributable to the developments that have taken place in Queensland. During the decade Queensland's production has risen from virtually nothing to 25,000 long tons for the current year. The so-far unprofitable Chillagoe scheme, though it is only responsible for a small proportion of the state's output, may, perhaps, be given credit for inducing public interest in copper ventures in the northern state. The wise government which owns the railways, took care to see that the state did not sink into disrepute by the comparative failure of the Chillagoe mines. By railway encouragement the government induced healthy settlement at Mount Elliott and Hampden.

The Cloncurry field, embracing as it does a huge area of cupriferous country, will be responsible for about 12,000 tons this year. Mount Morgan will barely reach the 10,000-ton mark. Next year should witness an improvement in the figures of this property, and the following year, when the new plant which R. Sticht, of Mount Lyell, is designing, is running at its top, there is no reason why Mount Morgan should not turn out 1000 tons per month comfortably.

New South Wales, which is the parent state of the Commonwealth, will probably be found to have turned out its usual 9000 to 10,000 tons. The apathy with which the mining industry is regarded in New South Wales is astonishing when one realizes its enormous potentialities. Given one-half of the railway encouragement which Queensland is affording its mines, the copper propositions of New South Wales would, in practically no time, raise the output from 10,000 tons per annum to 20,000 tons. Given an equal share of railway facilities, New South Wales could, from its already proved resources, turn out consistently 40,000 tons per annum.

In South Australia, Wallaroo & Moonta turned out copper at the same old rate of about 6000 tons per annum; while Victoria has practically no copper production worth speaking of. Strangely enough the most ready financial encouragement to the mining industry in all of the states where anything progressive is happening comes from South Australia and Victoria.

Western Australia cannot yet be spoken of seriously in a copper-producing sense. The properties of Ravensthorpe, which last year were making blister copper, have passed into the hands of tributors, and they send whatever ore they mine to the Port Kembla refinery, in New South Wales.

In Tasmania, Mount Lyell has done its best to live up to the production of 7000 tons of copper per annum, but the recent fire and loss of life which necessitated closing down almost entirely for a time, will probably result in a shortage in Mount Lyell production of approximately 1500 tons.

Summarized, it may be stated that although the production for 1912 will exceed that of any previous year, there are fewer mines operating for copper in the Commonwealth today, than has been the case for many years past.

As the price of copper, however, promises to remain at a higher level than the average of the past three years, there is a decided sentiment growing in favor of opening a number of the older properties. The processes pertaining to the mechanical reduction of the ore, as well as the facilities for fire treatment and refining locally under the altered metal-market conditions, make some of the older propositions appear attractive again. At the time of writing some of the old New South Wales ghosts, notably, Nymagee, Burraga, Cadia and others of less importance, are receiving further capital, and, if the market holds good, 1913 may witness an appreciable increase in the Australian output.

Tin and Coal

The high price ruling for tin was the means of encouraging operations on the various fields with the result that an enhanced production may be looked for in 1912, forecasted by the nine-months' figures of New South Wales, Queensland and Tasmania.

The output of coal from New South Wales during the first nine months of 1912 exhibited an increase of 404,000 tons on that recorded for the similar period in 1911. In Victoria the output from the state coal mine was being well maintained.

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Russian Mining in 1912

By John Power Hutchins*

In Russia, 1912 was a year of prosperity and progress in mining which, in common with other businesses, was helped by the generally favorable internal conditions. The Russian Empire is still an agricultural and pastoral country. The Russian peasant uses little metal in building his house, his wagon, his sleigh, and, then, iron is principally used. Copper has not a large use, although there are telephone and telegraphs in Siberia, and electric lighting in general in the large towns, but electric railways are not installed except in the largest cities. Thus, there is no electric street railway in all Siberia, although one is just being finished, at Vladivostock, of over 100,000 inhabitants.

The peasant, because of his ignorance, does not demand the complex and varied products that are deemed necessaries in more educated countries, and so, with a population of possibly 160,000,000, the annual total consumption of copper is only 41,000 tons, while that of the United States is 360,000 tons. Assuming the population of the United States and Russia to be 100,000,000 and 160,000,000, respectively, the per capita consumption per year would be 7.20 and 0.51 lb., respectively. Similar figures could be adduced for the consumption of other metals; thus there is a small total demand when the large population is considered.

Resume of General Conditions

Copper is protected by a duty of about 7c. per lb., but even with this encouragement there is not enough produced at home to supply the domestic demand and about 33% of the copper used is imported. The production of copper increased about 25%. The iron and coal mines have had a good year, better than in some time.

The gold mines have done fairly well. The total pro-

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duction has suffered somewhat, which was due to the troubles on the Lena mines where there was anticipated a production of about $10,000,000 worth of gold, while there was actually only about $4,000,000 won. Platinum mining has been helped by the high price of this metal, which was almost as high as in 1911.

Oil has commanded a higher price than in years, and this is stimulating exploration. The Baku deposits are, seemingly, gradually becoming exhausted and a reduced annual production is the result. Maikop, which was heavily handicapped by frenzied finance, is increasing its production and deep drilling is said to be giving better results. Zinc, tin, lead, quicksilver and asbestos, made only small productions.

Gold

The total gold production of the Russian Empire in 1912 was about $25,000,000 ($12,000,000 worth was produced in first six months). Of this, Siberia produced about 75%. In total gold production since 1700, the Russian Empire ranks third, being surpassed by the United States and Australasia, but still remaining ahead of South Africa. The total production is, however, surprisingly small, when one contemplates the wide distribution of gold over the great areas of Russia and Siberia.

The last year chronicled no discoveries of new, important auriferous deposits, nor have the several intensive searches of foreign prospecting parties, succeeded in demonstrating that there are large areas of placer ground suitable for dredging in East Siberia.

The foreigner, investigating placer fields in East Siberia, for dredging, finds a peculiar situation. Ground that averages about 25c. per cu.yd. from grass roots to bedrock can be worked by the primitive Siberian hand method at a small profit. It is no hindrance if the ground be frozen. In fact, it is often rather an advantage, for then no pumping is necessary. The following is a short description of the method.

Siberian Opencutting

Opencut mining is carried on as follows: Overburden is stripped, as it thaws, by hand shoveling, into horse carts, hauling to waste piles. The pay gravel, which usually constitutes only a small part of the total gravel section, as Siberia is a region of strong concentration of gold on bedrock, is hauled to a washing plant, up an incline which gives grade for sluicing and partial dump for tailings. Coarse tailing is hauled away in horse carts and part of the fine tailing is also hauled away in this manner, unless the washing plant is set where there is a fall to sluice away fine tailing. The overburden and pay gravel are in layers, and opencuts as much as 50 ft. deep are worked in this way, even when only about 10%, or even less, of the total gravel section is pay gravel. Therefore, there is not much left for working by the mechanical excavator, and where ground is 50 ft. deep and frozen, it has been worked more cheaply by the primitive Siberian method than any type of mechanical excavator could work it.

Although it is said that, in shallow gravel in Alaska and Klondike, a thawing cost of about 10c. per cu.yd. was recently noted, it is not likely that such shallow gravel could be steam thawed, and then dredged, in Siberia, as cheaply as it can be worked by the Siberian hand method, particularly when amortization is considered. It is said that, in some well authenticated instances, gravel containing about 20c. per cu.yd. is worked at a profit by Russians, in the Nerchinsk and Transbaikal regions, and that Chinamen and Koreans, in the same region, work ground that contains only 18c. per cu.yd.

Reasons for Low Cost

These figures are surprising until one remembers that wages are 50c. per day per man, and $1 per day for man and horse in East Siberia. It costs a Chinaman or Korean only about 12c. per day to live in East Siberia, and so they are satisfied with a low wage and do cheap work.

The extreme far east, or coastal region, from Vladivostock to Nikolaevsk, about 1000 miles in length, has been thoroughly mined by Chinamen and Koreans, who have roamed over this littoral region, probably for many centuries. These places are accessible to the sea and it was easy to transport food, by sail junks, to any place to be exploited. It has been assumed by analogy from observations in America, that the tailings in this coast region were susceptible of reworking by dredging, for the tailings and worked-out ground at Oroville have proved profitable when dredged. Indeed, it has been said, that the Oroville ground, which has seemingly been most thoroughly worked by hand, as judged by the tailing piles on it, was the richest for subsequent dredging. However, this analogy does not obtain in Siberia and, where ground has been worked out by Chinamen or Koreans in East Siberia, in general it cannot be dredged profitably.

Nor has much virgin ground been left that can be dredged profitably, even where not frozen, for these Mongolian miners, frugal and industrious, have worked ground near the coast, that has averaged, probably, not more than 10 to 12c. per cu.yd., judging by sampling results on the borders of the old workings.

A similar state of affairs is noted in the Urals, where there were, at one time, rich and quite extensive placers. Many of these placers were worked on a large scale by the method, described above, when serfdom which was equivalent to slavery, was in vogue. This resulted in low working cost. Since that time the old workings have been reworked several times and are still being reworked, particularly in the winter, when the peasants have nothing else better to do. The wages of men and women are only 25c. to 30c. and 12½c. to 15c. per day, respectively, in summer. So it is obvious that, in winter, when there is nothing to do and their time is practically valueless, and there is the constant urging for food and vodka, low-grade ground is worked; father, mother and children work together. Thus there is not much left in the tailings and old workings and not enough, in most instances, to pay for dredging. Then, also, these placer deposits are not like those in California, Alaska and Klondike, where several thousand acres may be found in one area, but in the Urals, deposits are comparatively small and thus, even where there is a tenor of, say, 10c. per cu.yd., there is not enough ground to warrant the installation of dredges large enough to have low working cost, and thus to make 10c. ground attractive.

There is still another aspect, the Siberian gold miner works cheaply when he operates by opencutting, employing only pick and shovel; but when he attempts to use machinery, of any kind, the cost rises surprisingly. As a recognition of the difficulty of using mechanical excavators, and of the low cost of hand work in Siberia, it is

interesting to call attention to the circumstance that the Amur railroad, now in course of construction, between Nerchinsk and Khabarovsk, a distance of about 1500 miles, is being built without one mechanical excavator of any sort or type. There is not even one simple drag or "slip" scraper, such as has been used to build thousands of miles of railway grade in America. Every pound of earth is handled on hand shovels and on poor shovels at that.

These facts are pregnant with suggestion to him who thinks there are tremendous opportunities for dredging in the Russian Empire.

Hydraulic Pump Dredging

The big problem in exploiting low-grade placers in Siberia is to evolve a method that will work profitably in frozen ground containing less than 25c. per cu.yd., even where there are only limited opportunities for getting gravity water through ditches under high head, but where there are opportunities for hydro-electric installations, and where wood and labor are cheap. A modification of the hydraulic-pump-dredging system will probably be installed. This will be modified so that there will be two giants, one with gravity, the other with pumped water, hydraulicking frozen ground to a gravel pump. The excess of water, that is not lifted by the gravel pump from the sump to the sluice, will be raised by a pressure centrifugal pump and returned to one of the giants. These plants work for about 10c. per cu.yd. in temperate climates. It is thought that the working cost per cubic yard will not be much, if any more, with a supply of gravity water and where fuel and labor are cheap.

There are a few opportunities for dredging and several successes to be noted. The most notable one has been that of the first American dredge, built in Siberia, late in 1911. This is a 7-cu.ft. close-connected bucket electric dredge with steel hull; and it is the first steel-hull American dredge to be built anywhere. This dredge has operated under difficult conditions in irregular old tailing piles, and in old workings in which timbers, old railroad iron, and various other scrap, such as accumulates at a mine where all sorts of mechanical excavation and transport had been tried unsuccessfully, were buried. It has also been difficult to keep up the level of the dredge pond, because of steep creek grade. A yardage of 3000 per day has been noted for considerable time, and a working cost of 4c. to 10c. per cu.yd., which is the cheapest work ever done in Siberia, was had.

It is interesting to compare the work of another 7-cu.ft. bucket dredge, but of European type, in the same region and under vastly easier conditions. This second dredge was working in perfectly loose, clean, small gravel, about 20 ft. deep, with a decomposed slate bedrock, easy to excavate. The dredge handled about 1400 cu.yd. per day, according to the estimate of operators, but seemingly less, according to my observations. Thus, the American dredge, though working under difficult conditions, due to irregular ground, old timbers, railroad iron and other scrap, dug more than twice as much as the European dredge, working under quite ideal physical conditions. It is likely that, had the American dredge been operating in this ideal ground, it would have handled 3500 to 5000 cu.yd. per day, and had the European dredge been called upon to dig old scrap piles, etc., it would have had even more numerous breakdowns than it did have, even though working easy ground.

It may be said that an American dredge weighs about twice as much, and can be installed for less than twice as much cost, and digs more than twice as much as a European dredge with the same-sized buckets. When one stops to consider the advantage of the stronger machinery —for instance, the American 7-cu.ft. bucket weighs about 2000 lb., and has a 5-in. pin, while the European bucket weighs about 700lb., and has a 2⅛- to 2½-in. pin—and the less lost time which results when one has unbreakable, and not fragile machinery, the American dredge, at more than twice the cost, would be more than justified.

Dredging in Central Siberia

This has not flourished, probably largely because of poor dredges, for the gold tenor is said to be such that profits would result, were proper dredges used.

The Lena region, famous for its gold output, was recently investigated for dredging and dredges will be installed. This is a region of frozen ground and with transport even more expensive than to Klondike, high tenor is necessary to warrant exploitation. Large boulders and a short working season add to the difficulties.

Dredging in the Urals

The Urals resemble the Appalachians in many respects, and the placers, in containing much clay, are similar. It is almost certain that in regions with rocks of great geologic age, and where there have not been earth movements in considerable geologic time, causing shifting of placers, or erosion, clay is usually found in alluvials in such quantities as to be a serious obstacle to extraction. Thus nearly the whole Ural region has gravel so clayey that disintegration is essential as a preliminary to passing the material over the gold-saving surfaces. Most of the Ural dredges have such clay-disintegrating machines in the form of the *chasha,* which resembles an agitator, more than any machine known in America.

Its principal drawbacks are intermittent feed and discharge, which always are concomitant with lower capacity than when continuity is had in the same-sized machine. It is planned to install *chashas* in series, so that continuous feed and discharge and a resulting large capacity will be had.

Log Washer in Siberia

A machine of the American log-washer type, but enlarged to give a capacity of over 1000 cu.yd. in 24 hr., was installed about two years ago in clayey ground in East Siberia. It is superior to the *chasha,* in only one respect, i.e., it has continuous feed and discharge, but it is not so good a disintegrator, nor can it handle as large material. It would seem that the disintegrator of the future will be an improved *chasha* rather than an improved log washer.

Copper

The total copper production for 1912 is estimated at about 33,000 tons. The respective production for the first six months were as follows: Ural region, 9180 tons; Caucausus, 4777; Siberia and Kirghiz steppes, 2126; byproduct from chemical works, 598; total, 16,681 tons. The production for the first eight months of 1912 was 22,300 tons.

These figures show that the principal copper region of the Russian Empire is the Ural—the Caucausus may be considered merely as the southern extension of the Urals. This is a region of old rocks; granites, limestones and crystalline schists. The principal mines are in sulphide bodies generally containing less than 5% copper, but well adapted to pyritic smelting. Generally favorable conditions for mining obtain, such as cheap labor, good transport, plentiful timber and water, accessible fluxes, inexpensive coke. The protective tariff, of about 7c. per lb., results in the price of copper being about 25 to 33⅓% higher than in London or New York. Foreign capital is largely interested in copper mining in the Russian Empire and the general success of these operations has stimulated an active search for new copper mines.

The Ural and Siberian steppe coppers had a good year. The Caucausus copper region is making progress toward eventual success. Here there are large low-grade pyritic deposits, but metallurgical difficulties, due to a considerable siliceous content, which hinders cheap smelting, have been a serious hindrance. However, in the last year it appears that such metallurgical developments were made, that this business will succeed after a long career of difficulty.

It is thought that Russia will eventually become an exporter of copper and, later, when progress shall result in an increased demand, it will again be imported. There is, undoubtedly, an immense future market for copper in the Russian Empire.

Platinum

Platinum had a prosperous year and the high prices of 1911 were almost maintained and without great fluctuations. This stimulated search for new placers, but no large important placers were found, although an extensive search was made. Some noteworthy extensions of existing deposits were made, and it is hoped that dredging can be done on a large scale.

The Urals produce about 90% of the world's platinum, and there is a movement on foot to make the production and control of platinum a governmental business. This is only one more demonstration of the paternal policy which holds in Russia. A law has been passed that will, when and if enforced, put the control of platinum under the government. An essential feature to the working of the scheme is a governmental refinery—platinum is now refined abroad. As this refinery is not yet built, nor are active measures being taken to erect it, it is likely that such control may not become a reality for several years. Meanwhile an active search is being conducted for platinum in South America, and it is possible that instead of controlling the platinum production and market, the Russian Government may find that competitive production, elsewhere, will make its efforts quite abortive.

Gold-vein Mining

No developments of important gold-vein mines were made in 1912. Owing to similar geologic conditions, it may be said that in most of the Russian Empire, except in the Altai Mountains, of South Siberia, and in the coast-range mountains of extreme East Siberia, the chances are just as good, or perhaps as bad, as in the Appalachian Mountains. Foreign capital invested in gold-vein mines has a disappointing return, as in past years.

Iron Business Prosperous on Government Orders

The iron business was in a prosperous condition, in part, because of large orders by the government for artillery, naval and railway equipment. Similar orders in America, where there is such a general and large use of iron and steel, would not have any marked effect, but in agricultural Russia, such orders make for a considerable prosperity.

The most important iron-producing region of the Russian Empire is South Russia, where the proximity of good iron deposits to coking coal gives a predominating position. The production for the first seven months of 1912 was: 1,659,000 tons of pig iron; 1,462,000 tons of billets, blooms, etc.; 1,230,000 tons of iron and steel finished products.

The Ural region is one of charcoal-iron making and the iron business has had a checkered career of recent years, with predominating black checks, but 1912 was favorable.

The production for six months was: 427,000 tons pig iron; 382,000 tons billets, blooms, etc.; 326,500 tons finished iron and steel products.

Poland produced in the first eight months of 1912: 263,000 tons pig iron; 336,000 tons blooms, billets, etc.; 261,000 tons finished products. The Moscow region, central Russia, produced in the first seven months of 1912: 48,700 tons pig iron; 108,000 tons blooms, billets, etc.; 89,000 tons finished products.

Coal and Oil

The oil business was prosperous and the recent price of 36 kopecks per pood, or ½c. per lb., was most stimulating (one pood equals about 36.11 English pounds, and one kopeck equals about 0.515 cents). The production of the Baku region further decreased and was about 240,000,000 poods (3,931,200 metric tons) for the first seven months of 1912. Maikop, where deep drilling is said to be giving good results, increased its output. The following record is interesting: Year 1909, 572,385 poods production; 1910, 1,304,801; 1911, 7,939,243; 6 months, 1912, 5,670,000 poods. Grozny district produced 37,000,000 poods (606,060 metric tons) in the first seven months of 1912. The coal mines had a prosperous year.

Minor Metals an Gems

Manganese is produced in small quantities in the form of pyrolusite in the Caucausus, near Nikopol. This ore is sold principally in Germany and England. There is a small amount of zinc produced in Poland and Caucasus, but the most important mine is in East Siberia, near Vladivostock. The ore is calamine.

There is no tin produced in the Russian Empire, although there is placer tin in Siberia. There is little lead produced. There is but one quicksilver mine. There is an increasing demand for cement as a result of active building operations. There is no nickel, antimony or sulphur mining, although deposits are said to exist. There are no deposits of vanadium, tungsten, bismuth, arsenic or molybdenum.

The Urals have been noted for the production of semi-precious stones, but recently there has been a decreased production. An English company, producing emeralds, is said to be in an improving condition, but without profit as yet. It is said that the tributers, who work the ground of the company, steal 30 to 40% of the gems.

Petroleum in the United States

The accompanying table shows the production of crude petroleum in the United States for 1910 and 1911 and an estimate of the production for 1912. Should this estimate be confirmed, there has been a slight increase in the oil production of the country, the increases in California and the smaller producing states being sufficient to offset the declines in the Mid-Continental and Illinois fields.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES
(In barrels of 42 gal.)

Field	1910	1911	1912
California	74,327,150	77,224,359	84,823,992
Colorado	239,794	226,926	200,000
Gulf —Texas	8,181,580	9,256,474	11,778,324
—Louisiana	6,841,395	10,720,420	(*e*)9,791,896
Illinois	33,143,362	31,317,038	28,400,000
Lima—Indiana	2,159,725	1,695,289	1,200,000
—Ohio	5,094,136	2,960,711	3,000,000
Mid-continental (*b*)	53,613,000	57,911,525	52,771,603
Kentucky-Tennessee	468,774	472,458	500,000
Appalachian (*c*)	26,089,900	26,117,960	26,000,000
Wyoming (*d*)	115,430	194,690	500,000
Others	5,000	5,000	5,000
Total	210,279,276	218,372,850	218,970,815

(*a*) Estimated. (*b*) Kansas and Oklahoma. (*c*) Pennsylvania, New York, West Virginia and eastern Ohio. (*d*) Includes Utah. (*e*) Includes Marion County, Texas.

Judging from the dividend disbursements by the constituents of the old Standard Oil Co., the year has been one of unbounded prosperity for the Eastern oil companies. The California companies also made a creditable dividend showing, although the year closed somewhat gloomily, owing to the Standard's refusal to take low-grade oil after the existing contracts expired.

The suit of the government, to recover large holdings of oil lands from the Southern Pacific R.R., announced in 1912, is of interest in the California oil situation.

The uses of oil showed further advances apart from the great increased demand for gasoline, both for pleasure and business, the success of the oil-driven "Selandia" and her sister ships greatly encouraged the designers of sea-going oil ships. The use of oil-driven tractors and agricultural machinery greatly increased, while if the report is true that a practicable carburetor for automobile use with kerosene has been devised, the industry may look for unprecedented prosperity in the future. Otherwise, the demand for gasoline in excess of the other requirements of petroleum products will still further unsettle the industry until chemical progress allows a greater cracking of the oils than is now possible. The use of oil engines to cut power costs in the remote mining districts where fuel is dear, and good water scarce is also a recent development.

In oil literature, the tower still was described by T. T. Gray ("The Mineral Industry," 1911, p. 577), which is, we believe, the first public description of modern refining methods.

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Review of California Petroleum Industry in 1912

By M. L. Requa.*

The interesting features of the California oil industry in 1912 divided themselves into two classes—financial and operative. Of these two phases by far the most interesting has been the financial phase.

The year has seen the dissolution of the Standard Oil Co. accomplished, and the Standard Oil Co. of California has assumed ownership of all California property. The result has been apparently in no way harmful to the Standard Oil Co. and in no way beneficial to the producer of oil. The Standard Oil Co. of California still continues to be the dominating factor, with its refineries at Point Richmond and at El Segundo.

Financial Aspects

The year has been full of rumors of the sale of the Southern Pacific holdings in the Associated Oil Co., but nothing of any definite character has been forthcoming. Rumors regarding the Union Oil Co. have also been plentiful, and during the month of November these rumors culminated with the sale of the property to the General Petroleum Co. The details of this sale so far as known are that Eugene De Sabla, Jr., representing the General Petroleum Co., made a payment on account of $500,000, the price named in the agreement being $130 per share, less certain commissions. Under the terms of agreement De Salba and his associates will have two years in which to pay the purchase price for the properties. It is understood that during this interim period the policy and the personnel of the company will not be materially altered.

There can be no doubt but that the sale will be beneficial to the oil industry of California as it will place the Union Oil Co. and the Independent Agency Producers upon a stronger financial basis than they have heretofore enjoyed. The expansion of the business has been so rapid that large amounts of new capital have been required to care for the increase. Under then existing conditions this money was not forthcoming. The bond issue put out by the firm of Hallgarten & Co. had coupled with it an option whereby they had first right to purchase the property or supply additional money. This option made it impossible to interest other banking houses in the enterprise and the growth of the business created such an insistent demand for money that it became an absolute necessity to take some drastic step. This turns out to have been taken by the sale to the De Sabla interests. Coupled with the holdings already owned by the General Petroleum Co., this gives them at once a position in the front rank of oil producers.

The disposal of the holdings of the Southern Pacific R.R. in the Associated is still a matter of doubt. It has been fairly well demonstrated that the Standard Oil Co. does not desire to acquire this interest. So far as the outsiders are concerned, the only two possible purchasers at this time would seem to be the General Petroleum Co. or the California Petroleum Co. which has been recently organized and has taken over the holdings of E. L. Doheny in California.

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A three-cornered combination of this kind, that is, the Standard Oil Co., the General Petroleum Co. and the California Petroleum Co., would be the greatest blessing that has yet come to the oil producers of this state, as it would mean a definite settlement of the question of marketing concerns for all time.

With three such corporations and the affiliations they would control, the organization of another marketing company in the state would be practically an impossibility. Such a lining up of marketing companies should be enthusiastically welcomed by the producers as they would have sufficient financial backing to permit of their caring for the industry in the most economical and satisfactory way. With the final working out of the ownership of the Union and Associated, the financial adjustment of marketing California oil will be settled.

Operating Conditions

There was no marked change during 1912 in the fields of the state. Midway continued to dominate the situation as heretofore. Much territory to the north and northwest was added to the field during the year. The estimated production of the various fields is as follows:

	Barrels
Midway	25,294,679
Coalinga	18,790,055
Kern River	10,903,040
Fullerton	5,807,685
Sunset	5,397,087
Santa Maria	5,326,261
McKittrick	4,779,340
Salt Lake	2,675,712
Belridge	1,356,149
Coyote	1,339,348
Lost Hills	1,237,165
Whittier	714,336
Ventura	647,043
Los Angeles	386,362
Newhall	117,530
Summerland	52,200
Total	84,823,992

These figures are not absolute, as November and December productions are estimated, and the oil used for fuel in the fields is not included. The estimated surplus oil on Jan. 1, 1913, is similarly calculated as 48,750,000 bbl. The surplus for 1912 likewise calculated is 7,101,465 bbl. There were no new fields developed and some territory that was looked upon with favor proved disappointing.

Heavy-Gravity Oil Refused by Standard Oil Co.

There was a movement in the last months of 1912 looking to the erection of topping plants by the producers of light-gravity oil and the selling of these tops. One of the results of this was a notice from the Standard Oil Co. that they would receive no oil so treated. It is quite probable that there will be some oil so handled, but it is also probably true that there will be disappointment on the part of some producers, the belief having gone abroad that almost any gravity of California oil could be successfully treated.

The action of the Standard Oil Co. in notifying the producers of heavy-gravity oil that their contracts will not be renewed created great consternation among the producers of heavy oil. That this action was a logical one is fairly plain. The Standard Oil Co. had in storage large reserves of heavy-gravity oil, and is now apparently able to secure all the oil it needs of lighter gravity. As long as this situation remains it has residuum enough to supply its needs and there is no necessity for it to buy heavy-gravity oil. Companies affected by this ruling associated themselves with a view of taking some definite action for the disposal of their product. Up to date there has been no disposal of this oil. The situation is a serious one for the producers of heavy-gravity fuel oil, although negotiations now on foot will probably solve the difficulty.

The gas line from Midway to Los Angeles was completed to the borders of Los Angeles but it is not yet in operation. This gas is to be sold wholesale to the Los Angeles Gas & Electric Co., and is to be retailed by them.

The pipe line of the General Petroleum Co. from Midway to Los Angeles is under active construction and will be in operation early in the spring of 1913. This line will be of eminent strategic value to the De Sabla properties in connection with the new consolidated company.

The new line of the Producers Transportation Co. from Junction to Port Harford is nearing completion. This is an 8-in. line and when completed will give one complete line from Midway to Port Harford and one complete line from Coalinga to Port Harford.

The Standard made a move to erect a refinery at Bakersfield with the probable intention of taking the asphaltum out of its heavier Kern River oils. This will accomplish two things: (1) Lighten the gravity of its oils; and (2) give it asphaltum in the San Joaquin Valley which can be sold to be used in connection with the State highway or shipped to Eastern points.

Since the advent of the Standard into the asphaltum business the price has dropped on San Francisco Bay from $14 to about $10. At these figures there is no money in the business except under conditions identical to those under which the Standard Oil is manufacturing and selling.

Taken as a whole the oil business of the state marked time during 1912 in an endeavor to readjust itself because of the developments in Midway. While there was not the improvement in prices that was hoped for by many, the situation on the whole is gradually righting itself, and the next 12 to 18 months ought to put the business upon a sane, stable, and profitable basis. There is no reason to expect lower prices and every reason to expect prices to advance.

Wyoming Oil Fields in 1912

By L. G. Huntley*

Production from the Wyoming fields was confined chiefly to the Salt Creek and Shannon pools, north of Casper, in Natrona County. In this field the two principal producing companies were hampered by insufficient storage and refinery capacity. The Midwest Oil Co. about completed the addition to its refinery at Casper, and will soon be able to handle 8000 bbl. of crude per day, whereas they now have only a capacity of about 2000 bbl. per day. The other refinery, that of the Northern Pipe Line & Refining Co., has a capacity of 3000 bbl. per day. Both are working to capacity night and day, and both had wells in the Salt Creek field, which were closed in for lack of storage capacity.

About 125 bbl. per day of heavy lubricating oil came from the Shannon field, just north of the main Salt

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Creek production. The oil from the Salt Creek field, after the naphtha and illuminating-oil constituents were taken off, was sold to the railroads for fuel.

The small production in the vicinity of Cody, in Park County, and in the northern part of Big Horn County, was not increased, and was consumed locally. A refinery at Cowley handled about 125 bbl. of crude oil per day from four wells at Cody. The production from the Dallas field, south of Lander, combined with that from the Plunkett pool to the north, amounted to about 130 bbl. per day, which was taken by the Chicago & North-Western Ry. The wells producing from the vicinity of Evanston and Spring Valley in Uinta County are small, varying from small "strippers" to a maximum of 25 bbl. per day. Part of this was refined by two small refineries in the district, while part was shipped to Utah for refining. The Standard Oil Co. supplied the market for illuminating and light oils in Wyoming from the Midwest refinery at Casper.

The principal activity of 1912 was in the Salt Creek and Shannon field and at Powder River to the north. The field was not producing up to capacity, which is difficult to estimate, as a number of the wells were not drawn upon; but the new addition to the Midwest company's refinery will take care of a great deal of this potential increase. Considerable wildcatting was done, but to a large extent by inexperienced men, and the wells were neither located with judgment nor were they drilled deep enough to constitute fair tests.

Meanwhile the uncertainty regarding the government's attitude as to the withdrawn lands has hindered development and Eastern operators were chary of entering the state. Another handicap to operation in the state was lack of transportation facilities, and their high cost. At present the rate by wagon from Casper to the Salt Creek field—a distance of about 45 miles—is 75c. per 100 lb. The railroad under construction from Powder River station to Thermopolis, and connecting through the Burlington, to Boise, Idaho, will open up large tracts of favorable oil territory.

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Petroleum in Illinois in 1912

By Raymond S. Blatchley*

Illinois began in 1912 the inevitable decline in oil production that comes to a thoroughly developed oil territory. The estimated production for the year is 28,400,000 bbl., as against 31,317,038[1] in 1911. The accompanying table covers the years from 1905 to 1912:

ILLINOIS OIL PRODUCTION 1905—1912.[2]

Year.	Bbl.	Value.
Previous	6,576	.....
1905	181,084	116,561
1906	4,397,050	3,274,818
1907	24,281,973	16,432,947
1908	33,686,238	22,649,561
1909	30,898,339	19,788,864
1910	33,143,362	19,669,383
1911	31,317,038	19,734,339
1912 (estimated)	28,400,000	25,500,000
Total	186,311,660	$127,166,473

The decline can be checked only by the development of new fields along the western side of the Illinois basin

ILLINOIS OIL PRODUCTION FOR 1912

	Runs, bbl.		Stocks, bbl.
Month.	Ohio Oil Co.	Tidewater Pipeline Co.	Ohio Oil Co.
January	1,870,413	94,918	18,393,303
February	1,872,170	96,597	17,706,835
March	1,970,421	97,681	17,278,537
April	1,935,015	101,550	17,001,288
May	2,104,689	109,161	16,636,329
June	2,099,720	91,752	16,235,353
July	2,241,787	98,986	15,689,994
August	2,013,419	100,834	14,682,822
September	1,885,226	95,254	13,949,064
October	1,915,926	106,638	13,039,507
November	1,700,705	101,173	12,307,725

and the northward extension of the La Salle anticline, along which the main fields lie. The basis of estimating the production, since only 11 months' returns are available, is to assume the December runs of the Ohio Oil Co., and the Tidewater Pipeline Co., equivalent to those of November and the tank-car shipments about 3,500,000 bbl., as compared with 3,407,757 bbl., according to Day, for 1911. The tank-car shipments, outside of the main fields, were made from Carlyle, Sandoval, and Allendale.

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[1]Day, D. T., the production of petroleum in 1911, Mineral Resources of the U. S. Calendar year 1911, Advance Chapter, 1912, p. 11.

[2]Loc. Cit.

The accompanying table gives the pipeline runs and the stocks, by months, of the Ohio Oil Co., and the runs of the Tidewater Pipeline Co., according to the *Oil City Derrick:*

The decline of production is further marked by the drain on storage which has accumulated since 1906, and reached its highest amount about Sept. 1, 1910, with 29,289,164 bbl. From this date to Aug. 1, 1912, the rate of withdrawal from reserved oil averaged 19,500 bbl. per day. Since that time the rate of discharge is about 30,000 bbl. daily, or about one tank per day. At this rate the reserve oil will be exhausted within a year.

Peculiar economic conditions which prevailed in 1912 and the demand for motor products caused a steady ad-

FLUCTUATION IN PRICES, PER BBL., OF ILLINOIS OIL IN 1912.

Date.	Above 30° B.	Below 30° B.	Date.	Above 30° B.	Below 30° B.
Jan. 1	$0.67	$0.57	June 27	$0.85	$0.79
Jan. 2	0.70	0.60	July 25	0.87	0.82
Jan. 6	0.72	0.62	Sept. 10	0.87	0.84
Jan. 25	0.75	0.65	Oct. 25	0.90	0.87
Feb. 3	0.78	0.68	Nov. 7	0.92	0.89
Mar. 4	0.81	0.71	Nov. 15	0.94	0.91
Apr. 24	0.83	0.73	Nov. 25	0.96	0.93
May 24	0.85	0.75	Dec. 5	0.99	0.96
June 13	0.85	0.77			

vancement in price of Illinois oils, which almost eliminated the grading of oil and price according to difference in specific gravity. The extensive increase in prices caused the highest annual value of oil in the history of Illinois. The accompanying table shows the changes in price of the two grades.

The Southeastern Illinois Oil Fields

The Clark, Cumberland, Coles and Edgar county fields (shallow oil territory) remained steady in production during 1912. The wells of this area produced from one to four barrels per day, which was considered profitable where a number of them were pumped on one power. The total daily yield was about 7000 bbl. Several wells were drilled in this area in 1912 to a depth of about 2500 ft., where small quantities of a high-grade sour oil were found. The horizon is thought to correspond to the

Trenton. Much drilling is contemplated to the Trenton limestone along the La Salle anticline from Westfield northward toward Mahomet.

Like the shallow fields, the Crawford County area maintained a low steady yield of a few barrels per well. There was but little new drilling done in the country.

The Lawrence County field, with its seven producing sands, still upheld its remarkable yield and did much to retard the decline of general production. Much new drilling was done in the McClusky limestone, in the southern and northern ends of the field. Several large wells were reported with initial productions from 400 to 2000 bbl. Many of the older wells in the same section were redrilled to this sand.

Miscellaneous Developments

A new field was tapped in August, 1912, about two miles northwest of Allendale, in Wabash County. The oil was found at a depth of about 1480 ft. and seemed to be governed by an isolated shelf along the western limb of the La Salle anticline. The field is about 1½ miles long and ½ mile wide. The gravity of the oil is about 37° B. There are about 18 wells, yielding about 2500 bbl. daily. The initial production of the Allendale wells ranged from 50 to 800 bbl., but the wells declined in yield rapidly until the average is below 150 bbl. Many dry holes were drilled, even in the midst of promising territory, several of which indicate a lenticular sand.

The Carlyle and Sandoval fields declined rapidly in their yield and assumed a steady low production similar to the Clark and Crawford County areas.

Several new wells were drilled in the Carlinville pool, making a total of five gas wells and four light-oil wells. The gas is utilized in Carlinville. There are also four gas wells of 2½ million cu.ft. capacity each, lying one mile south of Greenville, in Bond County. The Bond County Gas Co. supplies Greenville with abundant gas.

SIX-YEAR RECORD OF ILLINOIS OIL WELLS

Years.	Wells Completed	Wells Producing	Initial output Bbl.	Dry Holes	Average yield per Well Bbl.	Total Production Bbl.
1906.....	3283	2793	113,012	490	40.4	4,397,050
1907.....	4988	4260	139,163	728	32.6	24,281,973
1908.....	3574	3019	78,960	555	26.1	33,686,238
1909.....	3151	2593	89,756	558*	34.0	30,898,339
1910.....	2139	1671	93,256	468	55.8	33,143,362
1911.....	1364	1059	66,919	305	63.1	31,317,038
1912**.....	1127	874	60,928	253	69.7	28,400,000

* 70 gas wells included.
** Eleven months.

Barren wells were drilled in 1912 at Murphysboro, Ava, Grubbs, Denny, Nashville, Oakdale, O'Fallon, Virden, Watson, Carmargo, Keensburg, Jacksonville, Edwardsville, Villa Grove and other places.

On Jan. 1, 1912, it was estimated that 19,982 wells had been drilled in Illinois. Of these, 3152, or 15.7%, were barren. In the first eleven months of 1912, 1127 wells were drilled, with 253, or 22.4%, barren. The total up to Dec. 1, 1912, was 21,109 wells drilled, with 3405, or 16.1%, barren.

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Oil and Gas in the Midcontinental Field

By Erasmus Haworth*

The production of oil during 1912 in the Midcontinental field was not as great as for either of the two preceding years. This resulted in an increase in price which, in turn, stimulated development so that the total number of wells drilled was almost as large as for any year in the history of the field. This decrease in production became noticeable in the latter part of 1911. As a consequence prices moved upward slightly so that the new year began with crude at 46c. per bbl. This has been increased gradually throughout the entire year, usually by an advance of 2c. at a time. The last advance was made about the middle of November, which lifted the price to 83c. per bbl. As the production was uniform month by month and the advance in price likewise uniform the average price for the year was from 64c. to 66c. per barrel.

Development in Kansas and Oklahoma was confined almost entirely to working in and around the old pools and considerable wildcatting in a general westward direction. This resulted in the discovery of a new pool of oil and as near Cushing, substantially midway between Tulsa and Oklahoma City. Also, the fields around Ponca City increased their production materially so that at times as much as 1000 bbl. per day were shipped. The greatest activity in development was confined to the Electra field. Here many new oil wells were found and the interest was active and leases high in price.

No new purchasing companies of consequence entered the field during 1912. The Prairie Oil & Gas Co. was again the largest buyer, taking a little over 30,000,000 bbl. As its deliveries were 33,500,000 bbl., its stocks were considerably reduced. At the beginning of the year it had in storage 41,512,202 bbl., and at the end of the year only 38,734,838. It seems quite evident that this company wishes to hold its stocks around 40,000,000 bbl. Otherwise it would not have advanced the price so rapidly. It might be noted that during the period of lowest prices, when it was unable to take all the oil offered, its greatest stocks were but about 43,000,000 bbl. The next largest buyers were the Texas Oil Co., and the Gulf Oil & Pipeline Co. Here as usual these two companies bought substantially the same amount of oil each year. The independent refineries increased their purchases. The extra price in oil seems to have stimulated all of them.

The price of fuel oil advanced rapidly as crude went up. In the early part of the year the Standard Oil Co. at Kansas City declined to make yearly contracts for the supply of fuel oil, doubtless on account of the advancing prices of crude. Many consumers resorted to coal, so that the total consumption of fuel oil throughout Kansas was much less than usual. It is generally understood that with the beginning of 1913, time contracts may be made for fuel oil at reasonable rates, considering the price of crude.

1912 PRODUCTION IN THE MID-CONTINENTAL FIELD

Company	Bbl.
Prairie Oil & Gas	30,727,848
Texas Oil	8,488,064
Gulf Oil & Pipeline	8,333,366
Independent Refineries	5,097,325
Fuel Oil, crude	125,000
	52 771,603

*State geologist, Lawrence, Kan.

Natural Gas

The gas situation grew steadily worse throughout the year. Kansas City and other cities to the north of the fields did not have nearly as much gas as desired during the winter of 1911-12. Numerous cases of litigation were started, the most of which were settled by compromise. The Kansas Natural Gas Co. was bound by contracts to furnish gas for manufacturing purposes at low prices. In a number of instances the parties holding such contracts mandamused the company to compell it to furnish a sufficient supply of gas. Some of the lesser cities went into court for relief from the lack of a supply and obtained orders from local courts directing the Kansas Natural Gas Co. to supply them with gas according to contract. Finally other towns joined together and obtained an order from the Supreme Court of Kansas to the effect that the Kansas Natural Gas Co. should show no favors in its supply of gas to the various towns and cities in Kansas to which it had pipelines. During all this time the company was active in a search for new supply, hoping thereby to offset the constant decline in the older fields, particularly in the Hogshooter pool.

Unfortunately, no new gas pools of note were discovered in 1912. The closest approach is a small pool lying to the east of the Glenn Oil pool. Throughout this part of Oklahoma the rocks dip gradually to the west, so that the strata rise to the east from the oil pool. Just on the eastern border of the oil pool a number of strong gas wells were obtained, some of them reaching a capacity of 35,000,000 cu.ft. per day. Ultimately the Kansas Natural Gas Co. bought these and succeeded in extending its pipes to the wells during December. Many comparatively strong gas wells have been found scattered here and there over the whole field and westward throughout the Osage. The owners of such wells in some instances cannot find a market for their gas, and as a result they are complaining bitterly because the Kansas Natural Gas Co. will not buy their product. The facts are that such wells are so widely scattered it is doubtful if any company could be prevailed upon to build sufficient pipelines to connect them, because the amount of gas they would furnish in most cases would fall far short of justifying the outlay of capital in such a great extension of pipelines.

During the summer, the Kansas Natural Gas Co. abandoned its booster station at Scipio, and moved the pumps to Oklahoma, where they will now be used in gathering the gas and forcing it to Grabham station, near Independence, Kansas. Early in the autumn the Kansas Natural Gas Co. went into the hands of receivers, under Judge Pollock's division of the Federal Court. It was generally understood that this was a friendly action in order to protect the company from numerous litigations and to enable it better to extend its pipelines over wide territory and deal with the problem of prices in towns and cities to which it delivers gas. The receivers at once began a careful investigation in person of the gas supply. After what seems to be a thorough investigation they reported to the court early in December that they saw no grounds for hoping that the supply of gas available for Kansas City could be made greater than for the preceding year, and further that, there was no doubt, in their opinion, that the entire supply would last at best but a few more winters, thereby confirming in an official way the views I expressed in my 1911 report to the Public Utilities Commission of Kansas.

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The Eastern Petroleum Fields in 1912

By Frederick G. Clapp*

The year 1912 was one of the most profitable in many years in the Eastern fields, which include the states of Pennsylvania, New York, West Virginia, Indiana and Kentucky, also known as the Appalachian fields.

Blue Creek Pool Large Producer

This prosperity was due largely to the Blue Creek pool in Elk district, Kanawha County, W. Va., the first well in which was drilled in September, 1911. Operations were started in this pool by the Ohio Fuel Oil Co. and were pushed rapidly by that company, as well as by the South Penn Oil Co., the W. S. Edwards Oil Co., the United States Fuel Gas Co., the United Fuel Oil Co., by Davidson & Gates and some other producers. At one time this pool produced 18,000 bbl. of Pennsylvania grade oil per day, and a single well produced over 300 bbl. the first hour; but during the latter half of 1912 the production decreased. The Blue Creek pool was one of the largest in the history of West Virginia and the best in the Eastern fields for 20 years; it is of particular interest on account of being situated in a country which had practically been condemned by dry holes and which was believed by most practical oil men to lie "too far east." The oil has come mostly from the Squaw sand at a depth of about 1800 feet. The fact that the Blue Creek pool and the old Shinnston pool are both situated in the same geographical belt, in a portion of West Virginia that had been practically given up as unproductive, has stimulated drilling, so that wildcatting has been going on the past season in districts which were never before looked upon as promising. Judging by a number of showings which are being developed in new localities, the end of discoveries in West Virginia has not been reached.

Another interesting pool at present is on Falling Rock Creek, in Big Sandy district, Kanawha County, W. Va. A number of wells have been drilled there in the last few years, and in October, 1912, a 100-bbl. producer was drilled. In the same month a well of 600-bbl. initial production was obtained, but it declined rapidly. The sand in the Falling Rock field is the Berea grit. Roane County also attracted some attention in 1912, and at present the Scafford Run pool, in Spencer district of that county, appears promising. The Berea is the productive sand. The Carter Oil Co., the Fisher Oil Co. and the South Penn Oil Co. were active in that vicinity.

Ohio Field

Next to West Virginia in importance among the Eastern states is Ohio, where the Wooster oil pool has been opened in Wayne County, the Reading township pool in

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Perry County, and the Armstrongs Mills pool in Belmont County. The first two of these pools mentioned are a part of the Clinton sand field or Central Ohio field, which parallels the Central Ohio gas belt on the east. The Bremen and Junction City pools declined in 1912, while the Straitsville-Gore pool increased in area and production, becoming the most active oil development in Ohio. The Reading township pool is in reality an extension of the Junction City pool to the north; and like several other recently discovered pools, is surrounded by dry holes. As in the Bremen and Straitsville-Gore pools, the oil is of Pennsylvania grade. This is the first year that much excitement has existed north of Bremen and Junction City.

One of the most interesting localities is just south of the city of Wooster. This pool was discovered in 1911 by the Columbia Fuel Co. while prospecting for gas, and this company and the Ohio Oil Co. control the entire territory and operations. The producing sand is the Clinton. The price of oil, however, is less than that of Pennsylvania and Bremen grades, being only $1.43 late in 1912, the pipe lines having made a special rate for Wooster oil, classifying it between the Pennsylvania and Corning grades.

The New Straitsville field has the distinction of being one of the deepest oil fields ever developed in the East; and in that field a completed well, if set to pumping, costs about $9000. Operations in the New Straitsville-Gore field were pushed rapidly by the Chartiers Oil Co., Kachelmacher & Co. and by various smaller concerns. Wells of large volume have been frequent, and at times the production of this pool was above 3000 bbl. per day. Many wells in these villages have been drilled on town lots.

Another interesting locality in 1912 was in Muskingum, Coshocton and Licking Counties, where several companies have prospected for some time past, with the result that during the latter half of 1911 and in 1912 a number of good wells were drilled, which will open at least three new pools. The Gratiot-Black Hand pool was discovered in September, 1911, by the Columbus Gas & Fuel Co. at the south end and by the Everett Gas Co. at the north end. The Planet Oil Co. also has some good wells in this belt.

Several miles north of the Black Hand field the Arkansas Fuel Oil Co. has two good wells in Licking County, and this pool may connect with several small producers owned by the Ohio-Rochester Oil & Gas Co. in the vicinity. In Pike township, Coshocton County, the Ohio-Rochester Co. has several wells of small volume in what is known as the Norris pool. Efforts to find oil in quantity in other parts of Coshocton and Muskingum counties proved unavailing, but showings have been found, and conditions are such that pools are believed to exist at several localities. The same is true of several other localities in north-central Ohio, where the geological structure is favorable. It is not commonly realized that the Clinton sand of Ohio is continuous northward with sand of the same name in Canada, where it is also productive.

Ohio Gas Operations

An account of oil developments would be incomplete without mention of the operations of the gas companies. Since the pressure in the earlier portions of the gas belt has dropped off, the Central Ohio field has been extended both to the north and south, and at present every indication appears to be that it will in time be practically continuous from Lake Erie to the Ohio River. Ashland County is now the center of interest, and many good wells have also been drilled in Knox, Richland, Licking, Hocking, Medina and a few small gassers in Cuyahoga County. As a general statement, we may say that the volume of wells is small in the vicinity of Lake Erie.

The important gas companies operating in the Central Ohio field are the Ohio Fuel Supply Co., the Logan Natural Gas & Fuel Co., the Columbus Gas & Fuel Co., Central Contract & Finance Co., Upham Gas Co., Everett Gas Co., Columbus Natural Gas Co., Medina Oil & Gas Co. and the Heisey Gas Co.

In the shallow sand territory of southeastern Ohio the only discovery of consequence was the Armstrong Mills pool in Washington township, Belmont County, which was discovered in September. Ferguson & Co. were the discoverers and the Natural Gas Co. of West Virginia controls most of the neighboring acreage.

SUMMARY OF OPERATIONS FOR 1912

Month	Wells completed	New production (bbl. daily)	Dry holes	Daily average runs (bbl.)	Gross stocks at close of month bbl.
January	333	4,674	121	58,374	13,455,640
February	286	11,166	80	66,792	13,083,288
March	397	11,805	122	77,413	12,491,170
April	471	19,416	128	82,514	11,658,625
May	546	23,584	142	85,106	11,620,775
June	613	23,675	142	83,906	11,320,615
July	631	16,942	153	83,080	10,908,167
August	706	11,130	190	83,314	11,315,925
September	741	10,481	235	75,127	11,248,198
October	688	7,829	247	76,775	10,616,324
November	643	5,391	173	70,834	10,340,681
December	660a	6,000a	200a	73,000a	10,5000,00a
Totals	6715	.....	1933	76,353	.....

a Estimated.

In Pennsylvania operations were dull. The Canonsburg pool, which looked promising and which had several gushers at the beginning of 1912, failed to equal expectations, and later in 1912 the majority of its completions were failures. This field was a town-lot development and suffered from all the usual lack of wisdom in such developments. The Perrysville pool, in Allegheny County, likewise proved a disappointment, only a few wells of paying size being obtained.

Perhaps the greatest surprise of 1912 was the drilling of an oil well at Saginaw, Mich., as that state has never been considered as favorable by the oil fraternity. It was a small well, but caused much excitement and the leasing of several hundred thousand acres of land. The oil sand was reached at 2300 ft. and was 28 ft. in thickness. The oil is of 49 gravity, and of an amber color, with tinge of red. Future results are awaited with interest.

In October, 1911, there was some excitement at Newburg, Cuyahoga County, through the drilling of an oil well into the bottom of the Niagara limestone, but all efforts to develop this discovery into a pool failed. For a short time some excitement existed in the old Trenton limestone field of northwestern Ohio, owing to the discovery of a deeper "pay" in that formation.

Recently the possibility of finding production in unknown deep sands in the East has attracted several companies into drilling expensive test holes, and at present several of these in New York, Pennsylvania and West Virginia have exceeded 5000 ft. in depth.

An encouraging feature of 1912 for oil producers was the increasing demand for the light grades of oil, under the influence of which the price of Pennsylvania oil was advanced from $1.35 at the beginning of the year to $2 at the end of November. As might be expected, the in-

crease of price has stimulated development, and has particularly increased the work of the wildcatter. Hence, we may expect a number of new pools to be found in 1913. The prices paid for oil of various grades by the pipeline companies on Dec. 26, 1912, and also the increase in price during 1912 is shown in an accompanying table.

PRICES PAID FOR OIL OF VARIOUS GRADES IN 1912

Grade	Increase since Feb. 1, 1912	Price Dec. 26
Pennsylvania	55c.	$2.00
Mercer black	48c.	1.53
New Castle	51c.	1.53
Canada	22c.	1.53
Corning	55c.	1.50
Cabell	38c.	1.50
Wooster	41c.	1.43
North Lima	28c.	1.22
South Lima	28c.	1.17
Indiana	28c.	1.17
Somerset	32c.	1.15
Princeton	26c.	1.05
Ragland	17c.	0.65

Although it is not possible to give exact figures regarding the production of oil or of the number of wells completed during December, until some time in January, I have estimated these figures and give a summary of the operations for 1912. I may say that the *Oil and Gas Journal* figures are used for the monthly reports, with the exception of December.

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Russian Petroleum Industry

The total number of active petroleum refineries in Russia is 67, of which 30 are in Baku, 7 in Grozny, and 30 in other parts of the country. In the year 1911 these refineries treated about 6,500,000 poods of petroleum products, the Baku refineries accounting for over 80% thereof, which is distributed under the following descriptions, according to E. de Hautpick (*Mining Journal*, Nov. 2, 1912): Petroleum residue (ostatki), 68%; lubricating oil, 5%; kerosene, 22.9%; and other products, 3.5%. The refineries, according to products made, number as follows: Kerosene, 13; kerosene and lubricating oils, 9; lubricating oil, 1; benzine, 2; other products, 5.

The products of the refineries are taxed by the government at the rate of £3 19s. 7d. per ton. This tax falls on benzine (s.g. 0.730), gasoline (s.g. 0.730 to 0.770), kerosene (s.g. 0.815 to 0.827), astraline (s.g. 0.827 to 0.865), solar oil (s.g. 0.865 to 0.895), lubricating oils, vaseline, paraffin. The following are not subjected to tax: Crude oil, petroleum residue (mazout), and waste. For some time the petroleum excise has been yielding over £4,000,000 per year.

The production of petroleum at Baku for the first nine months of 1912 amounted to 4,970,967 tons, against 5,170,967 tons and 5,874,193 tons in the corresponding periods of 1911 and 1910 respectively, according to the *Mining Journal*, Oct. 26, 1912. The change in the extent of production by the largest firms, which account for 75% and more of the total is seen as follows: For first nine months 1912—Nobel Brothers, 77,419 tons less than last year; Zubaloff, 43,548 tons less; Mantasheff, 40,322 tons less; Pitoieff, 20,967 tons less; Mirzoieffs, 12,903 tons less; Baku Naphtha Co., 9674 tons less, and European company, 3225 tons less; while the Caspian company improved its output by 35,483 tons, the Caucasus company by 16,128 tons, the Russian Corporation "Nepht" by 17,840 tons. The average number of wells under exploitation in the period named was 2367, against 2221 wells in the corresponding period of 1911. New wells being bored numbered 182, against 125 in 1911; and 157 were completed against 94 in 1911. These figures show that the production of petroleum in the four principal Baku oil fields in 1912 declined in face of a large increase in the boring work.

In the first half of 1912 the production of petroleum at Grozny was 526,412 tons, against 613,000 tons in the first half of 1911. The flowing wells produced 782 tons in all against 42,441 tons in the first half of 1910. In 1912 exploitation was effected on 52 allotments with 219 productive wells, averaging 1694 ft. deep. New boring is being done on 42 allotments, where 72 wells are being drilled. All the petroliferous area where exploitation is proceeding, including all the Grozny productive wells, makes 1660 acres. The average productivity of one acre of petroliferous land at Grozny from the first day of the productive life of this oil field—i.e., since 1893—is 21,000 tons.

The total production of the Grozny oil field since 1893 up till 1/14 July, 1912, was 11,440,910 tons. The record year of the whole 19 years' exploitation was 1911. But the first half of the year 1912 is the first half-year with a diminished production on that petroliferous area.

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Oil in Texas and Louisiana in 1912

Present estimates for Louisiana and Texas oil production in 1912 indicate a large decline in the former state, and a larger increase in the latter, with a 5% net change. The year has been marked by quiet development, and advancing prices. In the Caddo field crude oil advanced about 20c. per bbl., in the Texas fields from 10 to 30c., according to the district.

The productions were: Louisiana, including Marien County, Tex., for 1912, 9,791,896 bbl.; 1911, 10,720,420; Texas, 1912, 11,778,324 bbl.; 1911, 9,256,474 barrels. The Caddo, Vinton and Jennings districts all showed a decrease.

Borings, near Pine Prairie, La., proved disappointing, and it is understood that the recent borings have been abandoned. The oil obtained by the Myles Mineral Co., at Pine Prairie, was peculiar, according to the U. S. Geological Survey, in that it contained no asphalt, gasoline, or paraffin wax. A controversy has been carried on between the Survey and A. F. Lucas as to who is responsible for the dome-theory of that region.

It appears that the waste which has marked other gas and oil fields will not be allowed in Louisiana, and that, through the efforts of a Public Service Commission, this state would serve as a model in the regulation of hydrocarbon explorations.

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Nitrate of Soda

Imports of Chilean saltpeter into the United States declined about 60,000 tons in 1912. There was, however, an increase in production in Chile variously estimated at from 50,000 to 100,000 tons. Exports to Europe increased about 220,000 tons during the last calendar year, so that the statistical position of nitrate is strong.

Prices in the United States increased in 1912 about $7 per ton, having been $2.25 per 100 lb. at the beginning of the year, and $2.60 at the close. The increase in ocean freight rates is regarded as partly responsible for the increase, though demand was good abroad.

New Mine and Metallurgical Construction

Inspiration Consolidated Copper Co.—This company will build a concentrator of 7500 tons daily capacity at Wheatfields, near Miami, Ariz. A railroad connection, 11 miles long, is being built. Extensive development work, about 4500 ft. per month, was done in the mine, and many surface improvements, involving ultimately several million dollars, were started.

Arizona Copper Co.—This company is building a smeltery at Clifton, Ariz., for which $2,500,000 was appropriated; Norman Carmichael, manager.

Commonwealth Mining & Milling Co.—A 30-stamp mill and 350-ton cyanide plant was ordered for the property, near Pearce, Cochise County, Ariz. The stamps will weigh 1550 lb. each. Control of the company is owned by the Montana-Tonopah Mining Co., of Nevada.

North Star Mines Co.—This California company, in addition to its old activities, is operating at the Champion mine, held under bond, a 40-stamp mill (20 stamps in operating condition) and is building an experimental cyanide plant of 40 tons daily capacity.

Republic Smelting Corporation—This company, of Los Angeles, Calif., is planning to build a smeltery of 350 tons daily capacity, near Calzona, Riverside County, Calif.; J. A. Chestnut, general manager; S. J. Gormly, metallurgist, and W. W. Wishon, consulting engineer.

Bonnieville Mining Co.—This company is planning to install a Huntington mill and build a cyanide plant at its recently acquired property, near Bonnieville, in Humboldt County, California.

Madera Enterprise Mines & Land Co.—This company is building a 10-stamp mill at a cost of $15,000, at Ahwahnee, Madera County, California.

Kate Hardy Mining Co.—This company, which recently purchased the Kate Hardy mines in Sierra County, California, is building a 5-stamp mill; at least 10, and possibly 20 more, stamps will be added in the spring. These stamps will be made by the Miners Foundry, at Nevada City. A. D. Grant, of Forest, is superintendent, and about $35,000 will be spent in improvements.

Sutton, Steele & Steele, Inc.—This company is building a dry-concentration mill of 50 tons daily capacity, complete ore-testing works, and laboratory at Denver, Colo. The company has also acquired, and will operate under a subsidiary corporation, the plant formerly belonging to the American Zinc Extraction Co., situated at the mouth of the Yak tunnel at Leadville, Colo. The new $100,000 manufacturing plant at Dallas, Tex., where S., S. & S. concentrating machinery will hereafter be made, is about completed.

Junta Consolidated Gold Mining Co.—This company, a consolidation of the Junta Gold Mining & Milling Co., and the Jim Crow Gold Mining & Milling Co., is building a 50-ton amalgamation and cyaniding mill, and a 3000-ft. aërial tramway, at Telluride, Colo. T. E. Thomas is general manager.

Hoosac Tunnel & Mining Co.—Peter McFarlane, of Central City, is building a 50-ton amalgamation and concentration mill for this company at Idaho Springs, Colorado.

Idaho-Continental Co.—This company has been building a wagon road from Porthill, Idaho, to the mines, a distance of 25 miles, at a cost of about $100,000. The grade does not exceed 4% at any place, and it is the intention to turn it into a logging railroad within a year. A compressor plant of 1300 cu.ft. per min. capacity has been ordered from the Ingersoll-Rand Co., and all the standard machinery for a mill of a capacity of 250 tons per shift has been ordered. An 800-hp. hydro-electric power plant on Boundary Creek, and a 13-mile transmission line to the mine, are being built. G. A. Heidinger, of Spokane, Wash., is president.

International Lead Refining Co.—A lead refinery was completed and placed in commission at East Chicago, Ind., in 1912. All of the buildings have not yet been completed.

Calumet & Hecla—This company is completing a regrinding plant at Lake Linden, Mich., in which 64 conical pebble mills will be used. A new electrolytic plant is being built at Hubbell.

Tamarack—This Michigan mill is being remodeled along the lines of the Calumet & Hecla mill.

American—At this Michigan iron-ore mine a concentrator of a nominal capacity of 500 tons per day was built, but operations have not yet passed beyond the experimental stage.

Boston & Corbin Copper & Silver Mining Co.—This company is building a 250-ton concentrator at Corbin, Mont., which, together with a 73-ft. headframe, will cost about $98,000; the mill was about 70% completed Dec. 1, 1912. Crushing will be done by gyratory breakers, rolls, and Hardinge pebble mills. Richards-Janney and Richards hindered-settling classifiers, and Deister sand and slime tables will be used. C. J. Witt is engineer in charge.

St. Louis Mining & Milling Co. of Montana—This company is building a cyanide plant of 100-tons daily capacity at Marysville, Mont.; Harry D. Quinby is manager.

Anaconda Copper Mining Co.—During the year 1912 the work of reconstructing the Great Falls smeltery, at a cost of $2,500,000, was begun; also reconstruction of the Washoe concentrator.

Bullwhacker Copper Co.—A leaching plant of 50 tons daily capacity was completed in 1912 and is now in operation at this mine, near Butte.

Elm Orlu Mining Co.—Work has been commenced on a zinc-ore concentrator of 350 tons daily capacity at this property of Senator W. A. Clark, at Butte.

Butte Central Copper Co.—During the year 1912, this Butte company completed a silver-lead-gold ore concentrator of 150 tons daily capacity, at its Ophir mine.

Butte & Superior Copper Co.—This company built a zinc concentrator of 200,000 tons annual capacity at Butte.

Butte & Duluth—A leaching plant is about completed at this mine in the Butte district, Montana.

Ophir—A mill and cyanide plant of 75 tons daily capacity was put in commission at this mine on the Comstock Lode, toward the end of October.

Ozark Smelting & Mining Co.—This company is building a zinc-ore concentrator of 150 tons daily capacity at Magdalena, N. M., at an estimated cost of $200,000. A Leschen aërial tram, one mile long and capable of delivering 25 tons per hour, will be built from the mine to the mill. L. P. Pressler is superintendent.

Prairie Mining Co.—This company is building a 250-ton concentrator at Miami, Okla., which will probably be put in commission late in February, 1913; S. J. Sullivan, manager.

American Zinc, Lead & Smelting Co.—This company, of which H. S. Kimball, of St. Louis, Mo., is president, is building a concentrator at Mascot, in the Holston River district of Tennessee.

Lead & Zinc Co.—This company will build a concentrator of 250 tons daily capacity at Metaline Falls, Wash. The principal part of the equipment has been purchased. Work is in progress on a dam and flume for the power plant and electric railway to connect the mine with the railroad at Metaline Falls, and a suspension bridge over the Pend d'Oreille River. The improvements will cost about $150,000.

Aurora Copper Mining Co.—A concentrator of 100 tons daily capacity which, with other improvements, will cost $100,000, is being built by the company at Chewelah, Wash., on ground adjoining that of the United Copper Company.

Vinegar Hill Zinc Co.—This company will build an electrically driven, 100-ton mill on its Scrabble Creek property in the Platteville, Wis., zinc district.

Granby Consolidated—Machinery has been ordered for a smeltery of 2000 tons daily capacity to be built at its Hidden Creek property, on Granby Bay, British Columbia; the estimated cost of the plant and other local improvements is about $3,000,000.

Lucky Jim Zinc Mines, Ltd.—This company, operating mines near Kaslo, B. C., is planning to build a concentrator of 100 tons daily capacity. The site for the plant and particulars of treatment have not yet been decided upon. A. J. Becker is superintendent.

Northern Customs Concentrator—This company added 40 stamps and accessories at $75,000 to its milling plant at Cobalt.

Cobalt Lake Mining Co., Ltd.—This Cobalt company is planning to double the capacity of its mill by building another 20-stamp unit at a cost of $40,000.

Nipissing Mines Co.—Ten stamps in the new low-grade mill at Cobalt, began dropping late in 1912; the mill will soon be completed.

Three Nations—The equipment for a 10-stamp mill was ordered by this company at Porcupine.

Porcupine Gold Mines Co.—In 1912 this company completed a 100-ton mill at its property, commonly known as the Vipond, at Porcupine, Ontario.

Hollinger—A 40-stamp mill was completed at this Porcupine property in June, 1912.

Dome—A 40-stamp mill and cyanide plant was placed in commission at this Porcupine mine in March, 1912.

Cinco Minas Co.—Excavations for the foundations for a 250-ton stamp and cyanide mill for this mine, in the Hostotipaquillo district, State of Jalisco, Mexico, has been completed and the concrete foundations will be laid in the near future. The mill machinery will be ordered as soon as the political outlook seems favorable.

Pueblo Smelting & Refining Co.—This company, which is beginning operations at the Magistral silver-copper mines, near Concepcion, Puebla, Mexico, will erect two smeltery units of 500 tons capacity each, the first of which, including blast-furnaces and reverberatory furnaces, electrical and other auxiliary machinery, is at the railroad station in Mexico, ready for hauling to the smeltery site.

Important Books of 1912

Among the more important contributions in book form to mining and metallurgical literature in 1912 were the following:

Bain, H. Foster (editor). "Types of Ore Deposits." (378 pp., $2).

Bansen, Hans (editor). "Das Tiefbohrwesen." Vol. I of "Die Bergswerkmaschinen." (517 pp., 16 marks).

Bansen, Hans (editor). "Gewinnungsmaschinen"—Vol. II of "Die Bergswerkmaschinen." (452 pp., 16 marks).

Boutwell, J. M. "Geology and Ore Deposits of the Park City District, Utah." Professional Paper 77, U. S. Geological Survey. (231 pp.).

Brinsmade, R. B. "Mining without Timber." (309 pp., $3).

Burnham, M. Howard. "Modern Mine Valuation." (160 pp., $3.75).

Cahn, Edw., and Wooton, W. O. "The Mineralogy of the Rarer Metals." (211 pp., $2.50).

Carne, J. E. "The Tin-mining Industry and the Distribution of Tin Ores in New South Wales." (378 pp.).

Carne, J. E. "The Tungsten-mining Industry in New South Wales." (100 pp., 2s. 6d.).

Chauvenet, Regis. "Chemical Arithmetic and Calculation of Furnace Charges." (302 pp., $4).

Dana, Richard T., and Saunders, W. L. "Rock Drilling with Particular Reference to Open Cut Excavation and Submarine Rock Removal." (314 pp., $4).

Del Mar, Algernon. "Stamp Milling." (134 pp., $2).

Dichmann, Carl. "The Basic Openhearth Steel Process." Translated and edited by Alleyne Reynolds. (334 pp., $3.50).

Engineering and Mining Journal (Editorial Staff). "Handbook of Mining Details." (372 pp., $4).

Farrell, J. H., and Moses, Alfred J. "Practical Field Geology." ($2.50).

Fawns, Sydney. "Tin Deposits of the World." (301 pp.).

Ford, W. E. "Dana's Manual of Mineralogy." Thirteenth edition, revised. (468 pp., $2).

Fulton, Charles Herman, "A Manual of Fire Assaying." (219 pp., $2).

Gilbert, Gilbert H.; Wightman, Lucius I., and Saunders, W. L. "The Subways and Tunnels of New York—Methods and Costs; with an Appendix on Tunneling Machinery and Methods and Tables of Engineering Data." (372 pp., $4).

Greenawalt, William E. "The Hydrometallurgy of Copper." (504 pp., $5).

Gunther, C. Godfrey. "The Examination of Prospects. A Mining Geology." (222 pp., $2).

Harbord, F. W., and Hall, J. W. "The Metallurgy of Steel," 1911. Vols. I and II. (933 pp., $12).

Havard, F. T. "Refractories and Furnaces." (356 pp., $4).

Hill, James M. "The Mining Districts of the Western United States." Bull. 507, U. S. Geological Survey. (309 pp.).

Hoover, T. J. "Concentration of Ores by Flotation." (200 pp., 12s. 6d.).

Hoskin, Arthur J. "The Business of Mining." (224 pp.).

Ketchum, Milo S. "Design of Mine Structures." (459 pp., $4).

Ketchum, Milo S. "The Design of Steel Mill Buildings and the Calculations of Stresses in Framed Structures." Third edition; revised. (556 pp., $4).

Levy, Donald M. "Modern Copper Smelting." (260 pp., $3.50).

McCann, Ferdinand. "Cyanide Practice in Mexico." (199 pp., $2).

MacFarren, H. W. "Text Book of Cyanide Practice." (291 pp., $3).

Of, Charles (editor). "The Mineral Industry During 1911." Vol. XX. (997 pp., $10).

Phillips, A. H. "Mineralogy." (639 pp., $3.75).

Prost, Eug. "Cours de Metallurgie des Metaux autres que le Fer." (888 pp.).

Ricketts, A. H. "A Manual of the American Mining Law." (500 pp.)

Rogers, Austin Flint. "Introduction to the Study of Minerals." (522 pp., $3.50).

Schaeffer, John A., and White, Bernard S. "The Chemical Analysis of Lead and Its Compounds." (63 pp.).

Schmid, de, Hugh S. "Mica: Its Occurrence, Exploitation and Uses." (411 pp.).

Smith, Edgar F. "Electro-Analysis." (332 pp., $2.50).

Somermeier, E. E. "Coal: Its Composition, Analysis, Utilization and Valuation." (175 pp., $2).

Stokes, Ralph; Thomas, James E.; Smart, G. O.; Dowling, W. R.; White, H. A.; Johnson, E. H.; Caldecott, W. A.; Johnston, McA., and Schmitt, C. O. "A Text-Book of Rand Metallurgical Practice." Vols. I and II. (468 + 438 pp.)

Stoughton, Bradley. "The Metallurgy of Iron and Steel." (537 pp., $3). 1911.

Tolman, C. F., Jr. "Graphical Solution of Fault Problems." (43 pp., $1). 1911.

Walker, T. L. "Report of the Molybdenum Ores of Canada." (64 pp.).

Wang, C. Y. "Bibliography of the Mineral Wealth and Geology of China." (70 pp., $1.25).

Weed, Walter Harvey. "Geology and Ore Deposits of the Butte District, Montana." Professional Paper 74, U. S. Geological Survey. (262 pp. and maps).

Wysor, Henry. "Analysis of Metallurgical and Engineering Materials. A Systematic Arrangement of Laboratory Methods." (82 pp., $2).